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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Interest and Learning

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The results of the study presented herewith seem to negate the commonly accepted idea that lack of interest reduces learning.

Should schoolwork be made interesting? Do pupils learn more when their interest is high and less when it is low? For many years teachers have been instructed to make schoolwork interesting. It is commonly accepted that teaching based on pupil interest is superior to the compulsion type. When, however, the educational influence (whether for good or evil) of certain commercialized recreation is shown to be great, when this influence is presumed to be due largely to interest, and when schools are indicted for failure because teaching is not entertainment, the assumption that lack of interest reduces learning must be tested. The present study furnishes evidence on this point.

The evidence indicates that there is practically no relation between interest and learning. On the other hand, the evidence is inadequate in some respects and this conclusion should be held as tentative.[1]

The fields of learning involved in the present investigation are woodwork, general metal, printing, and music. Furthermore, only part of the learning presumably produced was measured. The part measured was the special vocabulary of each field. In constructing the vocabulary tests, the authors checked the local courses of study carefully and used only those terms actually employed by teachers in giving instruction to pupils. The test situation consisted in matching the word with its correct definition. Several dictionaries were used in order to find definitions containing words all of which were simpler than the word defined. That differences in vocabulary growth can be accounted for by differences in teaching techniques, and that vocabulary and school success are definitely correlated, was found by O'Connor and are the assumptions upon which the validity of the vocabulary test is based.[2]

A generalized attitude scale, distributed in one of the meetings of the American Educational Research Association in Cleveland in 1934, and constructed by Ella B. Silance and H. H. Remmers, was adapted and used for measuring interest.[3] The authors of the present study established the validity of this scale by finding the extent to which 119 pupils made high attitude scores in those subjects they said they liked best. In 68 per cent of these cases the attitude score of the subject the pupil liked best was either the highest or next highest of any subject he had studied. Similarly, 108 pupils named the subject each liked least. In 76 per cent of these cases the attitude score of the least-liked subject was either the lowest or next lowest of any subject studied.

These pupils reacted on the average to eight subjects. If the attitude scale had no validity, the score of the subject liked best would be, by mere chance, as often the lowest as the highest. By chance alone one would expect the best-liked subject to rank highest or next highest in 25 per cent of the cases. The proportion of cases in which it did rank thus is, therefore, 2.7 times that to be expected as a matter of chance. Similarly, the proportion of cases in which the attitude score of the least-liked subject ranked either the lowest or next lowest of any subject, is 3.0 times that expected as a matter of chance. One may conclude, therefore, that the attitude scale has validity, that it measures the amount of like or dislike a pupil has for a school subject.

Having established the validity of the measures of learning and of attitude, and before proceeding to judge the truth or falsity of the hypothesis, one must also determine the reliability of the two measures. This is necessary because the size of the correlation that one can obtain between any two measures is restricted by their unreliabilities. Two things may in truth be perfectly correlated, but if measures of them are unreliable, the size of the coefficient one obtains will be small.

The accompanying table contains the

[1] In a progress report made earlier, the authors presented a small part of the evidence submitted here in support of this conclusion. See Roy R. Van Duzee and G. L. Betts, "Measuring Intangibles in Industrial Arts," *Western Arts Association Bulletin*, 20: 37–42, November, 1935.

[2] Johnson O'Connor, "Vocabulary and Success," *Atlantic Monthly*, February, 1934.

[3] See H. H. Remmers, "A General Attitude Scaling Device," *Psychological Bulletin*, 30: 719–20, 1933.

TABLE I. The Reliability of Vocabulary and Attitude Test Scores (Half-Grade Range)

Kind of Test	*Number of Cases*	*Reliability Coefficient*
Woodwork vocabulary	111	.60*
General metal vocabulary	70	.71*
Printing vocabulary (form A)	78	.72
Printing vocabulary (form B)	78	.74
Music vocabulary (form A)	50	.68
Music vocabulary (form B)	78	.77
Attitude scale (woodwork)	116	.60
Attitude scale (music)	103	.88

*The correlation between form A and form B. All other reliabilities in this column are estimated from the correlation between scores on odd and even halves of a single form.

reliability coefficients obtained. These are not high enough to warrant making judgments concerning individual pupils but their size is requisite for the purposes of this study.

Having established a satisfactory validity and reliability of the measures of learning and of interest, one may now examine the relation between them. In the third week of the second half of the 1934–35 school year, in a home-room period, by means of the Silance-Remmers generalized attitude scale (an adapted form), the authors secured reactions from more than 2,000 pupils in the West Allis (Wisconsin) public schools concerning each of the subjects in which they were enrolled the previous semester. This study pertains to the boys who had enrolled in certain industrial-arts courses — woodwork, general metal, and printing.

The correlation between attitude toward a subject and possession of the

TABLE III. The Correlation Between I.Q. and Attitude

		Attitude		Vocabulary		
Subject	Number of Cases	Mean	Std. Dev. of Distb.	Mean	Std. Dev. of Distb.	Correlation Coefficient
1	2	3	4	5	6	7
General metal	66	97.5	12.6	32.1	4.6	—.11
Music (form A)*	64	97.1	12.6	23.1	7.7	—.09

*Boys in general metal classes.

TABLE IV. The Correlation Between I.Q. and Vocabulary

		IQ		Vocabulary			
Subject	Number of Cases	Mean	Std. Dev. of Distb.	Mean	Std. Dev. of Distb.	Correlation Coefficients r_{12}	r_w
1	2	3	4	5	6	7	8
Woodwork	108	96.2	13.2	31.3	9.5	.55	.73
General Metal	67	97.8	12.6	31.5	10.2	.57	.67
Printing	69	98.2	12.2	12.8	4.0	.49	.59
Music (form A)*	67	97.8	12.6	7.1	3.2	.60	.74
Music (form B)	69	98.2	12.2	20.1	4.6	.52	.61

*Boys in general metal classes.

TABLE II. The Correlation Between Attitude and Vocabulary in Each of Four Subjects (Half-Grade Range)

		Attitude		Vocabulary		
Subject	Number of Cases	Mean	Std. Dev. of Distb.	Mean	Std. Dev. of Distb.	Correlation Coefficient
1	2	3	4	5	6	7
Woodwork	111	32.2	5.2	31.1	9.5	—.005
General metal	67	32.2	4.6	32.1	10.5	—.08
Printing (form B)	66	32.4	4.0	14.8	3.9	—.12
Music (form A) *a**	103	25.4	8.3	6.5	2.4	—.05
Music (form A) *b***	65	22.8	7.6	7.1	3.3	.08

*Boys in woodwork classes.
**Boys in general metal classes.

specialized vocabulary in each case, and also in the case of music, is given in the accompanying table. As inspection will show, these correlations are all so small as to be negligible. The conclusion is that learning and interest, under the conditions of this study, are unrelated; liking a subject seems to have no relation to success in it.

This is such a flat contradiction of a generally accepted principle of education that it needs explanation. It is generally supposed that a cause-and-effect relationship exists between interest and learning; that interest causes pupils to learn.

The most serious objection to these findings is that a vocabulary test may be inadequate as a measure of learning, especially of learning due to interest. It is well known that a vocabulary test is the best single test of intelligence. Consequently, correlating attitude with *vocabulary* is like correlating attitude with *intelligence:* little relation is expected. The correlations calculated in the present study show this to be the case. Table III shows that the correlation between attitude and I.Q. is negligible and Table IV shows that the correlation between vocabulary and I.Q. is considerable. These latter correlations, though considerable when corrected for unreliability, do not, however, account for more than half the community between I.Q. and vocabulary. (The corrected coefficients appear in column 8.) It appears, therefore, that finding a significant relationship between vocabulary and interest is not precluded by reason of the community between vocabulary and I.Q.

In the opinion of the authors, finding no significant correlation between interest and learning does not warrant abolishing entirely the theory that interest induces learning. Although it is probable that pupils must have a motive of some sort in order to learn, the writers believe that motives other than interest may be utilized by teachers. In fact, teachers may depend entirely upon other motives and regard interest merely as an incidental development. If other motives are as effective as interest, then only in the absence of any other motive could one get a significant correlation between interest and learning. It appears likely, therefore, that where pupil interest was lacking, teachers in the present study furnished other motives and induced learning nevertheless.

The conclusion that one may safely draw from the present study is that lack of pupil interest does not necessarily reduce learning; other motives may function in the absence of interest. The justification for interest must be on other grounds which, incidentally, may be amply sufficient.

A BUNCH OF KEYS

Shop teachers have a bunch of keys
To open wide their classroom door.
Regard them highly, if you please;
They really open a great deal more
Than just a shop. They open to youth
Some time-worn facts and the seeds of truth.
They open the hearts of growing boys
And place inside life's hidden joys —
Ideals, ambitions, yes, more than these
Are opened by some teachers' keys.

— *Orville Hayford*

Industrial Education and Industrial Museums

John Woodman Higgins

President, Worcester Pressed Steel Company, Worcester, Massachusetts

An endorsement of the American independent public-trade-school system of industrial education, in preference to outgrown apprenticeship-training systems for skilled craftsmanship; a plea for courses in related subjects and the humanities; a recognition of the cultural reaction of manual skill; an affirmation of the interdependence of handicraft and machine craft; and a suggestion of a definite contribution that every manufacturer owes to his industry. Address delivered at the 1935 A.V.A. convention at Chicago, Illinois.

"*Standard of living*" is an index of the civilization or *culture* of a period, nation, community, or person. As man struggles upward for light and truth, he experiences this change called *culture*. We seek to learn what produces culture. The *process* is more significant to us just now than the *product*.

Educators used to differentiate between "cultural" and "vocational" courses, but now they agree that *all* real education is *both* cultural and vocational, without distinction. Matthew Arnold defined culture as "*getting to know . . .* the best which *has been thought and said* in the world." But Huxley contended "having learned all that Greek, Roman, and Eastern antiquity has thought and said, and all that modern literatures have to tell us, it is not self-evident that we have laid a sufficiently broad and deep foundation for culture." We must understand the physical sciences which explain the very bases of life and the physical forces which condition life.

Then John Dewey said, "Our culture must be consonant with realistic science and with machine industry. Culture is the capacity for constantly expanding the range and accuracy of one's perceptions of meanings. The practical task of education at the present time is to struggle on behalf of an aim in which social efficiency and personal culture are synonymous." This comprehends modern industry because industry constitutes the major factor in "the range and accuracy of one's perceptions of meanings."

And now Dr. Arthur B. Mays (of the University of Illinois) declares, "Man's *mechanical* genius has through the ages been his chief means of social, cultural, and spiritual progress. Civilization itself is chiefly the outcome of the invention of tools and machines. The greatest danger of the present age is not the increase of scientific discovery and the rapid development of the machine industry, but that man in his slavery to educational tradition will continue to fail to incorporate the rich educative materials of science and industry into the educational program designed to prepare youth to live and manage modern life. Indeed, machine industry is far more characteristic of our civilization than is literature and the classics."

"Can one be truly cultured in this age and be unacquainted with the processes, the materials, the organization, the trends, and the social meaning of machine industry?"

"Industrial-arts courses can be enriched educationally by using the shop and drafting-room as motivating centers. The possibilities offered here should not be longer neglected."

Even those cultural and potential educational institutions — the American museums of Fine Arts — Greek-templed storehouses of rare treasures, are doffing their veils of seclusion and joining with their brothers, the universities, colleges, schools, libraries, science museums in liberal educational service to the new generation. Art and industry can no longer be kept apart — no more than education, culture, and industry. The hours spent by students in museums undoubtedly register a higher rate in "expanding the range and accuracy of one's perceptions of meanings" than those spent in college halls.

At last one of the oldest traditional museums of fine arts, the Brooklyn Museum (established in 1823 as an Apprentices' Library) has undertaken, under its new director, Philip N. Youtz, to re-establish the industrial center for coordinating art with the industries and with the lives of the people, broadening their visions and expanding their appreciations. This is epoch making.

We also acclaim in highest praise the initiative taken by the Ohio State Educational Committee in establishing their industrial-arts educational program, from pre-kindergarten through high school, and in assuring the co-operation of nearly three hundred colleges throughout the United States who are accepting an increasing number of industrial-arts credits toward college entrance. We industrialists are watching this system with faith and solicitude. To such students we purpose to open our manufactories as laboratories and museums — as I shall explain later.

Since industry is now the dominant factor of every life, from the cradle to the grave, the three R's fade out as fundamental objectives and take their proper place as techniques or tools. The Ohio program starts with childhood's first impressions and contacts — food, clothing, light, play, home, nature, and later the materials, machines, and processes of industry. Of course, these researches very soon require the techniques of reading, writing, and arithmetic, and in time as a pupil has need, Latin, Greek, and Calculus, as necessary tools for their development. But stupid tradition has so saddled typical primary schools with these minor techniques that students seldom get as far as the fundamentals of health, human relations, and industry. They have to pick these up in the street.

Sixty-five per cent of all secondary-school boys in Toledo last year elected this industrial-arts course. These boys should become intelligent choosers and users of avocations and vocations, of industrial contacts and products.

Ohio stands unique among the states for this educational program, based on the industrial arts. She will reap her re-

Medieval wing of the John Woodman Higgins Armory

ward in more abundant life. However, these liberal courses do not purport to train skilled producers; they graduate efficient consumers — not "technocrats" nor "brain trusters," but capable, intelligent citizens.

American industries need 100,000 new skilled craftsmen every year to replace losses by change, retirement, and death. In the past, these craftsmen were trained by the industries. Manufactories as well as the professions undertook to educate their recruits through indentured apprenticeships and exclusive guilds, but that was before the days of centralized, organized education and specialized machine mass production.

During the World War, American industries, under government conscription, established school departments, engaged teachers, and educated their own workers. Skilled craftsmen then were as scarce as jobs are today. But with manufactories snowed under by orders at 50 per cent profit and 90 per cent of this routed back to the Government in taxes, no wonder green apprentice boys were wanted at any expense. That was twenty years ago. That apprenticeship system, starved by five years of depression, was killed by the Federal Apprenticeship Committee, exploited by labor unions seeking to control and monopolize skilled labor — a racket which was outlawed with the NRA. One of the last crimes of the New Deal was to throttle forever the faltering heart of the American apprenticeship system which had been sharing this job with the public trade schools. Even this "first aid" resuscitation of the National Youth Administration has not revived the patient, and we question whether its needle is sterile and its pulmotor is charged with oxygen. The old private-factory-indentured apprentice system is passing out, but a new and better day is dawning.

Educational expediency as well as economic necessity now demands the immediate expansion of our public trade and technical schools to meet the call for educated, all-round skilled craftsmen who can create and maintain our new complex, mechanized, mass-production system.

Less than 1 per cent of the $3,000,000,000 expended annually by the taxpayers of the United States on public education is spent on industrial courses. Ninety-nine per cent is devoted to training for other professions, many of them overcrowded and likely to remain so for years.

We are faced with the apparent anomaly of 10,000,000 potential workers out of work and an actual shortage of 100,000 skilled craftsmen. Our 16,000 public vocational schools with an enrollment of over 1,000,000 students include 2,300 trade schools with an enrollment of 500,000. But they are graduating less than 15,000 trained craftsmen a year to fill these 100,000 vacancies, and the apprenticeship system is supplying less than 5,000. That good old law of supply and demand offers a high reward to these trained graduates, and reports indicate that trade-school application waiting lists are larger and unplaced-graduate rolls smaller than those of the universities and colleges.

No other program is functioning adequately to meet this 80,000 annual net shortage of skilled craftsmen, so manufacturers will have to lower their standards, curtail output, and train operators from uneducated incompetents, until the schools rise and meet this need. We know that manufacturers are not fitted for educating boys and girls, but trained vocational teachers are fitted for this job.

So-called "child labor" prohibition has thrown thousands of boys and girls onto the streets and into the courts, and recent crime records indicate that 15-year-old youths now suffer more from unemployment than from "child labor" exploita-

tion. The proposed Federal child-control amendment would extend these bans to 18 years of age, and establish a National Commission to proscribe other activities of youths. Here is the vocational schools' new opportunity. But under "economy" smoke screens, labor-legislative lobbyists periodically introduce bills relieving public schools from providing courses in industrial and household arts, and restricting the work of trade schools to "exercises" which must be destroyed.

Such measures for curtailing, controlling, and monopolizing the supply of skilled craftsmen — a selfish and stultifying objective in itself — forebode national evils more serious than any industrial abuses they purport to eliminate. Are we not convinced after fifteen years of painful experience that extreme prohibition laws defeat themselves? Modern youth demands liberty, admittance, and participation with us, and deserves wider and better opportunities for expression rather than less. Shall we substitute adequate counterattractions before supposed evils are outlawed, or lapse back to codes, creeds, and idleness?

The American Colonies were industrial communities, whose leaders expressed intelligent appreciation of the educational and stabilizing value of industry to all people. Now the village blacksmith and carpenter shop have disappeared — even the workbench in the cellar, where a boy could make his own dog house, gives way to household luxury. Automatic "conditioners" are replacing furnaces and transforming basements into modernistic cardrooms dominated by chrome-plated bars for the new dispensation of private tastes.

View of modern wing

Manual dexterity and Yankee ingenuity manifest themselves early, but if ignored or neglected during the adolescent period while comic strips, movies, and schools are emphasizing quick-wittedness and static knowledge, can we expect modern America to develop an art-craftsmanship emulating that of medieval Japan or Italy? We are complacently substituting machines for "sweatshop child labor," knowing that the peasants of "backward" countries, where these abuses have always thrived, exhibit the highest manual skill.

Yale, Harvard, and Princeton started as vocational schools, but slight attention is now given to manual or artistic attainment, although psychologists agree that manual work, wisely guided, develops imagination, initiative, confidence, creative ability, co-ordination, personal efficiency, and intelligence — as well as artistic appreciation — all essential qualities in a well-rounded cultural education. Books and lectures are secondhand information, and while this is no disparagement, it emphasizes the fact that books do not cover the entire field of education. We become what we create.

Notwithstanding Dr. Jacks' declaration that "Knowledge of any kind which fails to eventuate in *skill* is at best half grown, and because half grown, an actual danger and a source of cant, uncertainty, and fear," we know that we cannot force manual skill onto every boy and every girl. We even do well to question that decree of our Puritan ancestors that all labor is "good for the soul" of everyone who dislikes it. Only a few master craftsmen and great artists will emerge from our vocational classes. Ability to earn an honest living, important as this is, is not the great end of industrial-arts work nor the highest reward of manual proficiency. Ruskin said, "The entire object of true education is to make people not merely do the right things but *enjoy* the right things — not merely industrious but to love industry."

Since the first paleolithic sculptor chipped extra flints a million years ago to trade for his neighbor's extra canoe, boys have grown up into business, teeming with creative accom-

plishment. It took five hundred thousand years to learn to polish those chipped flints, but since then intelligence and industry have advanced through manual work in geometric progression.

Of course normal boys now prefer shops to schools. For thousands of generations boys have been eager to "help big men make real things" in shops. Some boys run away from school to get this thrill; others remain solely because of law. Manufacturers who expect trade schools to educate journeyman craftsmen must work with them and give them real shops, production machines, and commercial jobs in place of toy laboratories and politics.

Even children perceive that daily chores are now performed more easily and quickly by machinery than by hand, and naturally they reason, "Since efficiency is the goal of our scientific age, why should *we* bother with hand work?" They overlook the fundamental fact that the perfection of these machines is due to the co-ordinated skill of educated hands. Machines never produce better work than the hands of their masters. Every child, rich or poor, is a prospective dependent or master of machines. Machines cannot put art into an object; only hands and hearts can do that. The great art masters of history were inspired by the incentive of expression through super hand craftsmanship, with no realization that their works would immortalize their names in art.

No machine ever produced a masterpiece that could not be improved by a master hand. Take, for example, the hardened-steel plates surfaced and lapped true on a Norton Precision Grinder — their truth tested to one-millionth of an inch, with spectroscopic light-waves, through a *hand*-lapped optical glass. Even that infinitesimal inaccuracy of one-millionth can be reduced by exquisite hand-lapping, but this hand work cannot be further improved by machinery. In the last analysis, the hand is man's highest appeal. This is the ideal relationship for both handicraft and machine perfection. When the hand loses its cunning, the whole scheme fails. Our legs may atrophy as the automobile is perfected, but if our hands atrophy, we shall degenerate in all branches of evolution.

Science is now amplifying all our senses to fourth dimensions, enabling us to record and utilize vast zones of vibrations that our untrained nerves never sensed before. But there is no substitute for the sense of touch, nor royal road for co-ordinating our fingers with our brains. Practice only makes perfect.

America advances with efficient engineering. We champion mass production by super machines, *ad infinitum*, but we must recognize that the best machine is only an amplified tool in the hands of its master. Manual dexterity is the prerequisite. Always the hand is supreme, because it is the mind's best tool. Then second in importance comes the perfected machine. We may stress quantity production, but only as a means to this end.

Hoofed animals with insensitive feet and no hands to arouse their curiosity never attain the brain development of the ape. Ability to grasp with the hand is the first indication of intelligence, and monkey curiosity is a great mental stimulus and brain developer. Therefore, some museums have replaced the familiar "Don't Touch" signs with instructions for handling. Laziness with machinery may retard manual dexterity but will never throw the race back to primitive stupidity, because if the hand loses facility, machines will deteriorate and thereby induce more and better hand work to meet the demand — a self-sustaining and recuperating system which is already operating beneficently.

An expanded public-trade-school system will relieve manufactories of the interruptions and expense of educating recruits. In return for this relief, industrialists will co-operate with the schools toward efficiency and local adaptation, and will open their plants to visiting students as demonstration laboratories. More than this, they will provide special *craft museums* illustrating the processes and evolution of their specialty in all ages and places. The modern exhibit will present their masterpieces of industrial art for the comparison, judgment, and criticism of every visitor, be he student, employee, or prospective customer. The day of the secret process has passed. Manufacturers are proud of their efficient, safe, attractive plants, workers, and products. No school can have a Rosenwald or a Deutsches Museum, but neighborhood factories can provide better exhibitions of their own lines in their own plants.

Every manufactory should have its own specialized museum. Just as the lawyer accumulates documents in his library, and the surgeon preserves specimens in his laboratory, so the manufacturer of buttons or dirigibles, employing one person or a thousand, should assemble his collection of exhibits representing his industry, illustrating his service, and recording the history of his chosen specialty. Here he surrounds himself and his associates with that friendly atmosphere where creative ideas germinate. His reference file expands into a library, and his specimen case into a laboratory.

Every craftsman should exhibit his masterpiece in friendly surroundings, even though he starts with a soap box in the corner of his shop, a sample case in his office, or a pedestal in a museum of fine arts. Some friend will recognize his demonstration of cultural advance and stimulate the next step. Pride established, challenged, or pricked inspires progress in production engineering, as well as in other arts.

The industrial museum at the plant of the Worcester Pressed Steel Company at Worcester, Massachusetts, is a museum, library, and laboratory of pressed-steel products, from all places and all times, established with these purposes in view: to inspire steel workers; to attract superior recruits; to stimulate art in industry; to extol steel craftsmanship; and to inform the public.

Here the machine worker sees the value of his own labor in the finished construction, and recognizes his relation to the onward march of industry. He compares his product with masterpieces of the past — his tools, his wages, and his comforts with those of his predecessors in this, his chosen craft. He senses the fun in his job. He catches the romance of tradition, the call of the present, and a vision of the future.

This steel collection is housed in its own unique steel-and-glass building adjoining the steel mills. One wing is devoted to modern products, headed by that crowning example of mass production — the modern automobile — 90 per cent pressed steel. Glass cases display various stamped and forged steel parts for airplanes, radios, and innumerable other machines, as well as specimens of meteorites, iron ore, and raw steel. Dies and punches used in the mass production of millions of duplicate stampings are shown. Products of other steel mills are freely displayed alongside the output of the home shops, and labels bear the manufacturers' names.

The *ancient wing*, devoted to the products of our predecessors, is dominated by a group of sixteenth-century armored knights mounted on chargers ready for the joust, all in full steel panoply. Here are displayed many other superb masterpieces of the armorer's art, accepted by connoisseurs as examples of the fine arts and worthy of place among the approved masterpieces of the world's recognized painters and sculptors.

The entire main floor is devoted to products of the Steel Age, but inspection may begin in the gallery of the medieval wing, starting with utensils of the Stone Age and of the Bronze Age, including Greek and Roman armor, then passing to the war implements of the early Iron Age, and on to the crusader's armor and the transitional weapons.

Schoolboys visit the museum, attracted first by these knights in steel armor, who stir their imagination. They stay to examine the steel stampings and dies in the *modern wing*, and ask admittance to the machine, press, and rolling mills adjoining. There are no "Don't Touch" signs in the museum.

Guides and thought-provoking labels showing comparative weights, strength, and costs, extol the use of pressed steel and the art of cold-rolling, drawing, stamping, and heat-treating strip steel. To restore the zeal and pride of craftsmanship to the present-day machine worker, and to emphasize his rewards in recognition, self-respect, and satisfaction, are the motives behind this diversion.

The museum is connected by several stairways and elevator with the offices and the mills where current steel products are designed and made. These buildings comprise the active part of the exhibition, and are as open to visitors as the museum galleries are open to the shop workers. The doors are open free to the public ten hours daily, except Sundays and holidays. That people are interested in such technicalities is demonstrated by the attendance of 10,000 visitors a year since the opening five years ago.

With scientific equipment, processes, and alloys beyond the wildest dreams of our predecessors, our fields of opportunity stretch farther ahead than their paths of history trail behind. In quality of material and workmanship, modern products stir our pride. We excel in accuracy, efficiency, uniformity, durability, and low cost in mass production. But from the viewpoint of artistic design we suffer in comparison to the masterpieces of our predecessors. Their ranking craftsmen were the great artists. If we have neglected that rare quality, beauty, we must look to the art schools to popularize *art* — to reinstate *art in industry* — to elevate consumer demand and producer zeal, toward making all quantity products beautiful as well as useful.

These steel workers acknowledge steel to be man's medium *par excellence*. Its strength, abundance, dependability, and adaptability, its beauty of texture and tone, surpass all other materials for man's supreme expression — industrial art.

I close with these gallant words of Anatole France: "For years men have tried to divide art into two branches, calling one 'fine' and the other 'industrial,' each incapable of surviving in such isolation. The wish, no doubt, was to make us believe that the 'industrial arts' were so soiled by the degradation of labor that they could not enter the regions of pure beauty, as though beauty did not draw from materials its only outward form. Come then, ye by whom the common things of life are clothed with beauty. Benefactors of men, lead us on our way to the community of the future."

General Metal-Shop Organization

G. A. Wickman

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A description of a general metal shop in which machine work, benchwork, forging, welding, and foundry work are taught.

The popularity of the general metal shop is apparent. Because of its wide range of activities, its low relative cost, and its adaptability to an industrial-arts program, this type of shop is firmly established in our educational system.

Although the content of a general shop is well defined, very few have activities whose combinations are identical. In many schools the content of the general shop may include a variety of unrelated activities, as, for example, metalwork, electricity, and auto mechanics. Very often these combinations are organized for the purpose of offering exploratory work and the teaching of home mechanics. In some schools a general shop may consist of related activities such as general metal or general woodwork. This type of shop is suitable, not only for exploratory purposes, but also for specialization in trade and technical training.

From an analysis of the general shop it is evident that, although this type of shop offers a wealth of educational features, its teaching problems are comparatively difficult. Most educators agree that when units of instruction are increased, teaching difficulties likewise are increased. The factors which enter into these difficulties are organization, records, testing, and instruction. Through proper shop organization and well-devised teaching aids, teaching difficulties may be reduced to a minimum, while at the same time individual instruction which is essential to the success of a general shop, will be facilitated.

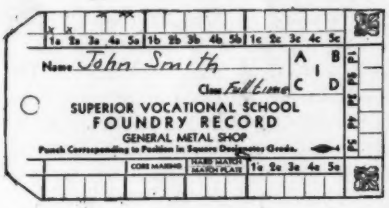
In conjunction with the regular exploratory program, the general metal shop of the Superior Vocational School offers courses in actual trade training. As many as four trade groups may constitute a class. The courses of study are made flexible, so that a student may devote his time to one particular course, or he may vary his work to suit a specific interest. To conduct a class of this type requires efficient organization and unusual teaching technique. Since much time is devoted to individual instruction, it has been necessary to devise lesson plans, testing methods, and record forms which are conclusive and easily administered. Process, information, and assignment sheets are used to supplement instruction.

The general shop in this school consists of machine work, bench work, forging, electric and acetylene welding, and foundry work. The equipment consists of three machine lathes, one shaper, one planer, four forges, one electric welder, four acetylene torches, and four foundry benches.

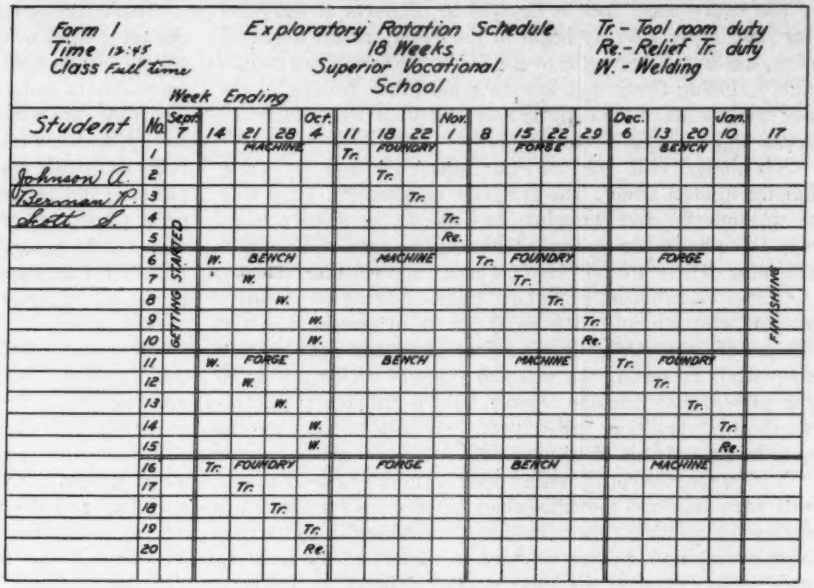
To illustrate the type and level of work which is undertaken, projects are listed as follows: *Machine* — wood turning lathes, drill presses, wood joiners, and small tools; *Forge* — ornamental wrought-iron lamps, tables, fireplace equipment, smoking stands, and flower stands; *Foundry* — book ends, brass floor lamps, door stops, and other ornamental castings.

Typical information and process sheet headings are shown herewith. Each is numbered and titled to correspond with a permanent progress record card. To check student reading, each information sheet is provided with a check test of the objective type.

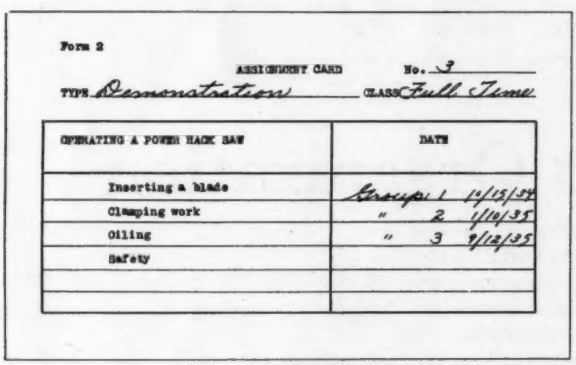
A permanent progress record card which has proved very satisfactory is also shown. These are made in two colors, with white cards for beginners and yellow cards for advanced students. Both sides of the card are used to record processes, assignments, and projects. Provisions are made for recording assignment tests, monthly grades, achievement remarks, and shop hours. Each department of work is broken into definite units. As a process or assignment is completed, it is recorded and graded in its proper place.



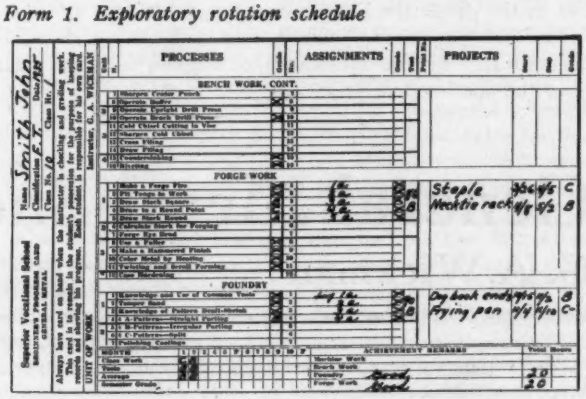
Form 4



Form 1. Exploratory rotation schedule



Form 2



Form 3

A foundry record card is made out for all foundry students. This card consists of letters in groups corresponding to types of molding which are listed as follows: (*a*) straight parting line, (*b*) irregular parting line, (*c*) Split, (*d*) Cored, (*e*) Floor. Each practice pattern is lettered according to a particular group of molding. These patterns are molded in their proper order. After a practice mold is graded it is usually broken. Upon completing a unit of practice molding a project is chosen. No project may be selected which does not involve practice already completed. After a unit of molding is completed, grades are transferred to the permanent progress record card. Projects, however, are recorded directly on the progress card as soon as they become completed.

An exploratory rotation schedule, form 1, provides a definite plan for routing students in an exploratory course. This schedule may be varied according to the number of students in the class, the length of the tryout period, or the number of subjects which are being offered. It provides an equalized and efficient distribution of student hours.

A class-assignment card, form 2, is used to plan and record class demonstrations and lectures. One card is used for each individual assignment. Although each card is numbered in sequence, it does not necessarily mean that they must be presented in that order.

TYPICAL PROCESS SHEET

General Metals

FORGING — ASSIGNMENT 3

Unit 1 Information 2a

Name _____

TONGS

The size of the tongs is measured by the parallel opening of the jaws.

To hold the work properly while forging, it is important that the correct tongs are used and that they fit the work properly. To become skilled in the handling of tongs requires practice. Tongs should always be hung on the rack when they are not in use. They should not be left in the fire to become hot if it can be avoided.

Fig. 1

Special tongs are made for special work and for this reason it is frequently necessary for a blacksmith to make tongs or reshape those already in stock.

Figure 1 shows ¼-in. flat-jaw tongs. These tongs are used for ¼-in. stock only. Likewise, ½-in. tongs are used for ½-in. stock only. Correct and incorrect methods of using tongs are shown in Figure 2.

Figure 3 shows ½-in. bolt tongs. These

Fig. 2

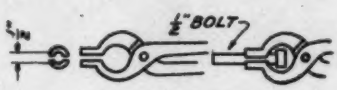


Fig. 3

are made for holding round iron and have a hollow portion for the head of a bolt. These tongs are convenient and easy to handle.

Figures 4, 5, and 6 show tongs for special work. Figure 4 shows an eye tong used for forging rings and bands. The box tongs shown in Figure 5 are used for holding square stock. The pick-up tongs shown in Figure 6 are used for picking up pieces of hot iron, and for holding pieces while tempering. These tongs are but a few of the most common kinds. Special tongs are made to fit special forms.

Questions: All questions must be correct before credit is given.

1. Fill in the correct name for each tong under Figures 4, 5, and 6.
2. To become skilled in the handling of tongs requires ————.
3. Tongs should not be left in the ————.

Fig. 4

Fig. 5

Fig. 6

Thoughts for This Year's Graduates

Douglas B. Hobbs

Pittsburgh, Pennsylvania

The youth of today may feel that the days of opportunity have vanished. A study of ancient, modern, and even recent history disproves this.

The high-school graduate, just entering the working period of his life, may today lack a feeling of self-confidence. Regardless of his ambition, talent, and faith, he may feel that the opportunities enjoyed by other generations of high-school graduates are not to be his. This trend of thought has been particularly emphasized by the graduates of the past five years. Yet throughout the ages, no matter what the times, men in all walks of life have gone ahead and made names for themselves.

Great men are usually pictured as men of mature years, contrary to the fact that some of the most brilliant men in history were at the height of their fame when they were quite young. Alexander, at 30, was undisputed ruler of the civilized universe. Napoleon I was crowned emperor of the French at 35. Henry Clay was a United States Senator before he was constitutionally eligible. Stonewall Jackson was a general at 37, William Cullen Bryant wrote his *Thanatopsis* at 17, and Michelangelo was a full-fledged artist at 16.

These names are shrouded in history. What about our own times? The name of Bobby Jones will always remain bright in sports. When Norma Shearer first met Irving Thalberg, vice-president of a great motion-picture company, he looked so young to her that she thought he was an office boy. William S. Paley was president of the Columbia Broadcasting Company before he was 30, and Robert Maynard Hutchins was president of the University of Chicago at 30. Rush Drew Holt was chosen to represent the people of West Virginia as a senator before he was 30 and had to wait several months before he could take his seat. The name of Lindbergh will remain forever glorious in the annals of aviation because he, as a young man of 25, was the first to span the distance between New York and Paris in one hop.

The list of young men who have made names for themselves is truly interminable. At this time, there is one young man who deserves particular attention. He is Charles Martin Hall who, at the age of 22, revolutionized the aluminum industry through his discovery, 50 years ago this month, of the electrolytic process of making aluminum.

Before Hall's discovery, the metal had been produced by a chemical process in which aluminum chloride was reduced with metallic sodium. This process was extremely costly. The first bits of aluminum had been made in 1825, and in the years succeeding this date and prior to 1886, the cost of the metal had gradually come down to $8 a pound; but aluminum was far from being a common commercial metal.

Every scientist of note and every professor of chemistry was interested in inexpensive aluminum because enough was known about this metal to stimulate enthusiasm. It weighed only a third as much as iron or copper, and if it could ever be used in quantity it would lighten the dead weight of industry. One of the many interested in the possibilities of aluminum was Frank Fanning Jewett, a professor in chemistry.

Jewett was graduated from Yale in 1870, attended Goettingen, where he specialized under highly trained German teachers, then became a research assistant to Wolcott Gibbs of Harvard, and from 1876 to 1880 he was professor of chemistry at the Imperial University of Japan. His value to aluminum lay in the fact that he discovered the man who discovered the new process.

Jewett was called to Oberlin College in 1880. Here, in his first year, he became interested in a high-school boy who used to come to the laboratory to buy a few cents' worth of chemicals, test tubes, and other apparatus. The boy was Charles Martin Hall.

Hall entered Oberlin in 1881. Although an all-round student who majored in the classics, he had a special liking for science, which he studied under Professor Jewett. A chance remark, made one day by the Professor, turned Hall's attention to aluminum.

"The man who discovers a process," said Professor Jewett, "by which aluminum can be made on a commercial scale, not only will be a benefactor to the world but will also be able to lay up for himself a great fortune."

Hall nudged Dan Bradley, a classmate, and said: "I'm going after that metal."

He tried various methods in vain, and finally turned his

mind to the idea that electricity might help to separate the metal from its ores. The idea came to him in his senior year, but not success. Hall was graduated in 1855, and in the summer of that year turned his attention more than ever to this problem, laying aside other inventions on which he was working. He spent the summer in Professor Jewett's laboratory. That autumn, when it was impossible for him to continue in the school laboratory, he rigged up one of his own in his father's woodshed.

To make electricity for his experiments, he needed a great deal of apparatus which he did not have and could not buy because he was too poor. But he was not daunted. He borrowed every type of battery he could find, and then he and Professor Jewett made additional batteries of cups, tumblers, and other containers. Such crude instruments would bring a smile to the lips of any laboratory technician, but they turned out to be sufficient for Hall's purpose.

During his woodshed days, Hall reported to Professor Jewett frequently, but none of these meetings had the importance of the one held on February 23, 1886. Hall had been working away on his experiments when, on emptying his crucible, he found several globules of a grayish metal. Here, at last, was the aluminum he had tried so hard to get!

He could scarcely wait for the little pieces to cool. Excitedly he grabbed them, while still warm, and ran off down the street to Professor Jewett's office, shouting: "Professor, I've got it!"

The Professor looked at the globules in Hall's fist and marveled. A 22-year-old boy had discovered that which had baffled the mind of science for more than sixty years! A boy just out of college, a boy who had taken the classical course and who, as such, was normally supposed to be far more familiar with iambic hexametres than with chemistry; a boy who had stood behind Caesar when he built his bridge across the Rhine, and who had seen the body of Hector dragged around the walls of Troy, was responsible for one of the greatest metallurgical discoveries of the nineteenth century.

At A is shown the largest shovel dipper ever built of any metal, made of aluminum for use in the open-pit coal mines of Northern Illinois. The dipper is so large that a long-wheel-base sedan can be comfortably placed inside it. When full, it holds 32 cu. yd. of soil. At B is pictured a huge 25-ton all-aluminum dump truck which has seen 24-hr. daily service at Boulder Dam transporting loose rock, earth, and dirt from the excavation. At C are illustrated ice-cream molds made of aluminum. D shows aluminum chairs, which because of their lightness and strength have earned a favorite reputation. Photo of this setting by Drix Duryea, Inc. At E and F are shown various kinds of cheese wrapped in aluminum foil

Hall arrived at his conclusion by thinking out his problems with a scientific logic remarkable for a person of his years. And the discovery of the electrolytic process of making aluminum was not his only one. Among other inventions, he experimented with tungsten as a filament for electric lights. He gave up his activities in this direction when the more immediate problems of aluminum commanded his entire attention. Had he continued, the tungsten lamp might have put in its appearance twenty years earlier!

Hall died in 1914. The prophecy of Professor Jewett was amply fulfilled. Hall left more than $14,000,000, a third of which went to Berea College, a third to the cause of education in the Orient, and a third to his alma mater. Fame and fortune were his reward, just as his Professor had predicted. His life proved conclusively that there is indeed a future for young men if they are willing to apply themselves wholeheartedly and unselfishly.

In the 28 years in which Hall was identified with the aluminum industry, the metal made great strides. Yet even Hall would marvel, were he alive today and could see what progress has been made since his death. The development of strong aluminum alloys had just begun, giving to the metal the strength of structural steel, and from these alloys, many heavy-duty applications have been made.

Today, there are aluminum truck and bus bodies, dragline booms and dippers, streamlined trains, bridge railings and floors, 50-ton cranes, and cruiser hulls. Aluminum is used in the machine-tool industry, in street, subway, and railroad

car construction, in the manufacture of motor coaches and airplanes, and in many types of engines.

Aluminum is tough enough to protect the occupants of armored trucks, it is sufficiently delicate to be used in precision instruments. It is used to decorate buildings and it is the pigment portion of a protective type of paint. It is used in furniture and gift ware, in monuments and toys, in fishing tackle and in telescopes.

And it was given to the world by Charles Martin Hall, a 22-year-old boy.

How Do You Grade or Mark?

Stanley J. Pawelek

State Teachers College,
Winona, Minnesota

The writer's suggestions, while general in nature, may, nevertheless, be helpful in arriving at a sane method of taking care of this important part of the teacher's duty.

The problem of marking in our school shops is a most perplexing one, and seems to require a great amount of study and investigation. Most of the shop teachers who have given thought to it have tried to do the job in as objective a manner as is possible, but their best efforts have fallen short of the three criteria of objectivity, reliability, and validity, which are generally set up for scoring or marking devices. At their best, these marks represent only the opinion of the teacher, and vary greatly from school to school, department to department, and teacher to teacher. A top mark from one instructor may mean any one of the marks in the scale from another. As a result, students have been overheard to say, "I got a *C* from Mr. Jones in shopwork, but that is just as good as an *A* from Mr. Smith."

The lack of agreement of marking which is in evidence in our schools in general, and in our shops in particular, is not due to any fundamental weakness of our marking systems — whatever types are employed — but to the lack of understanding of what the marks that are assigned really measure and represent. It would be an interesting experiment to have a representative group of shop teachers each assign a mark to the same project. The results would undoubtedly compare in no small measure to the study made by Starch and Elliot, who conducted an experiment in the marking of examination papers in History, English, and Geometry, in 1912 and 1913.

It cannot be denied that a great many factors enter into the making of a project in shop, but it can be questioned seriously whether all factors of skill, accuracy, attitude, effort, citizenship, behavior, persistence, and others, should and *can* be used in determining a mark in shopwork — or any other kind of school subject. Can we as ordinary human beings, and with the tools which we have at our disposal, feel that we can assign a certain number of points to each of the factors which we consider important, and emerge with a composite score which represents a worthy mark for a boy's efforts in a shop course? Can we get the same results if we mark this work at various times? What does this mark represent after we do arrive at it? Is it a mark on the project, the process involved, or the personality of the boy, or what? Some of these questions would undoubtedly embarrass the average shop teacher.

It seems that one should not criticize and tear down a system without being able to set up one that is better, and this writer admits that it is a gigantic task to make definite recommendations without possessing any scientific basis, but he also recognizes that opinion based upon experience is valuable. There seems to be a fertile field here for a master's thesis, but until further investigation is made, the following recommendations and suggestions are offered, with the hope that they will be of some assistance to shop teachers:

1. Before assigning a mark in any shop subject, be sure that you have the *level* of the class in mind. Standards will vary at the various levels of educational attainment.

2. Do not allow personality traits, absence, misbehavior, and similar factors to enter into your marking. If a rating of these traits is desired or required, rate them independently of the boy's achievement. A mark given for a piece of shopwork is supposed to be a rating of *achievement alone*. The lack of proper personality traits will automatically penalize achievement without having the teacher make a conscious effort to do so.

3. Have definite standards of size, design, workmanship, and finish in mind while you are marking, and decide the ratio of one to the others.

4. Make use of snap gauges, templates, and any other devices, while marking accuracy and workmanship, so that this mark may be as objective as possible.

5. Speed, accuracy, and general "finesse," or workmanship, are the three factors which determine the *achievement* of a boy in shopwork. These cannot be marked by simply looking at a project which he has made, but must be evaluated from observation of him at his work.

6. Do not forget that we are not teaching the making of *projects* but the assimilation of *processes*, therefore we cannot mark the projects alone without knowing the other factors involved. A high quality of performance invariably results in a good project, but the teacher cannot be certain that the project is the work of the individual who handed it in unless he watched him make it.

Marblehead-Class Sloop

Claude Wm. Horst

Milwaukee Vocational School
Milwaukee, Wisconsin

(Continued from page 121, April, 1936, issue)

Trimming the Boat for Lateral Balance. Remove the lead and apply at least two coats of paint to the outside of the hull. After the last coat is dry, attach the lead again and place the boat in a tank of water to check for lateral balance. Since the mast, rigging, deck, and deck beams are not in place, the boat will float higher than shown in the drawing. If the thickness of the hull shell is as shown in Plate I, this will be about 3/32 in. at the bow and 1/16 in. at the stern. If the boat floats slightly too deep after all the rigging is attached, the balancing may be perfected by using a file and removing the slight excess

from the fin. If, however, one end or the other of the boat floats too deep for correction, the pattern of the fin will have to be changed and the lead recast.

Fitting the Deck and the Deck Beams. Rabbet the top edge of the hull so the deck will fit as shown in Figure 18. Put in the deck beams, placing them as shown in Figure 16, and notching them into the hull as shown in Figure 18. Add two lengthwise structural members

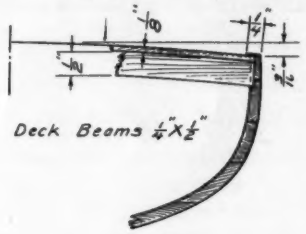


Fig. 18

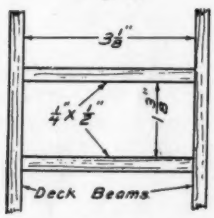


Fig. 19

under the mast plate, Figure 19. The deck is made of ⅛-in. material. To determine its shape, it is advisable to fit a template of heavy paper to the hull and mark out the deck piece from it. Cut holes in the deck piece for the hatch as shown in Figure 20, the mast as shown at A in Figure 21, and the slot for the jib rack as shown in Figure 22. To cut the hole for the rudder port, tack the deck piece in place temporarily, and spot the hole by pushing the rudder tube, which at this stage should be extra long, through the hole already drilled through the bottom of the hull. When the end of the tube comes in contact with the deck, tap the other end with a hammer so that an impression will be left on the deck piece. This locates the fore and aft position of the tube. Draw a center line on the deck piece, and, regardless of whether the impression is exactly on the center line or not, drill the hole on it. Later, when the deck is permanently in place, drive the tube down through the deck and into the hole. Apply at least three coats of varnish to both sides of the deck.

The Adjustable Mast Plate. The mast may be stepped on the deck, or it may extend through the deck and be stepped on the keel. The adjustable sliding plate which is shown in Figure 21 may be adapted for either arrangement. It is made of two pieces, A and B, both of which are made of 22-gauge brass. A, the base plate, is later screwed to the deck. B, the movable part, has a piece of threaded tubing welded to it, which supports the mast. A nut screwed to the tube holds the sliding plate in position. If the mast is to be stepped on the deck, the elliptical hole shown in the base plate A, and the hole in the sliding plate B, may be omitted. If the mast is to be stepped on the keel, make the two parts with the holes for the mast to extend through as shown in Figure 21.

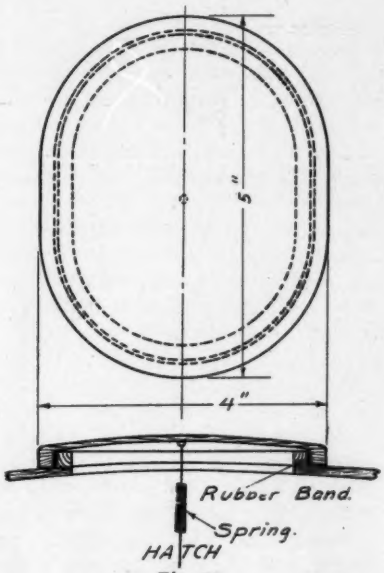


Fig. 20

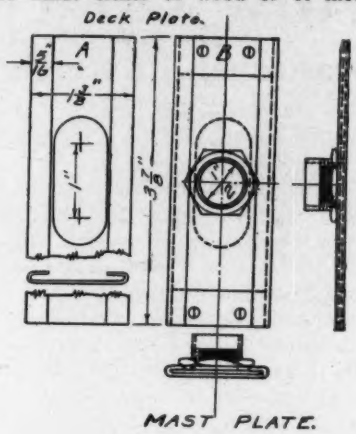


Fig. 21

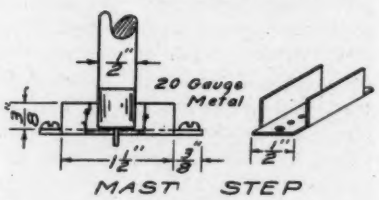


Fig. 23

JIB RACK.

Fig. 22

Paint. Apply at least three coats of paint and one of enamel to the inside of the hull.

Mast Step Plate. The mast step plate is made of 22-gauge sheet brass and shaped as shown in Figure 23. It is attached to the bottom of the hull with No. 3 by ½-in. r.h. wood screws.

Attaching the Deck. Screw the jib rack in place on the underside of the deck as shown in Figure 22, using No. 1 by ⅛-in. r.h. screws. Fasten both travelers to the deck as shown in Figure 34, using small brass bolts. Then fasten the deck to the hull with No. 20 by ¾-in. brads. To attach the covering boards use No. 20 by ½-in. brads.

The Hatch. The hatch may be made square in shape if desired. The coaming has a rubber band stretched around it to act as a gasket. The hatch cap is held in place by a spring attached to a wire hook which in turn is hooked into a screw eye in the bottom of the hull, as shown in Figure 20.

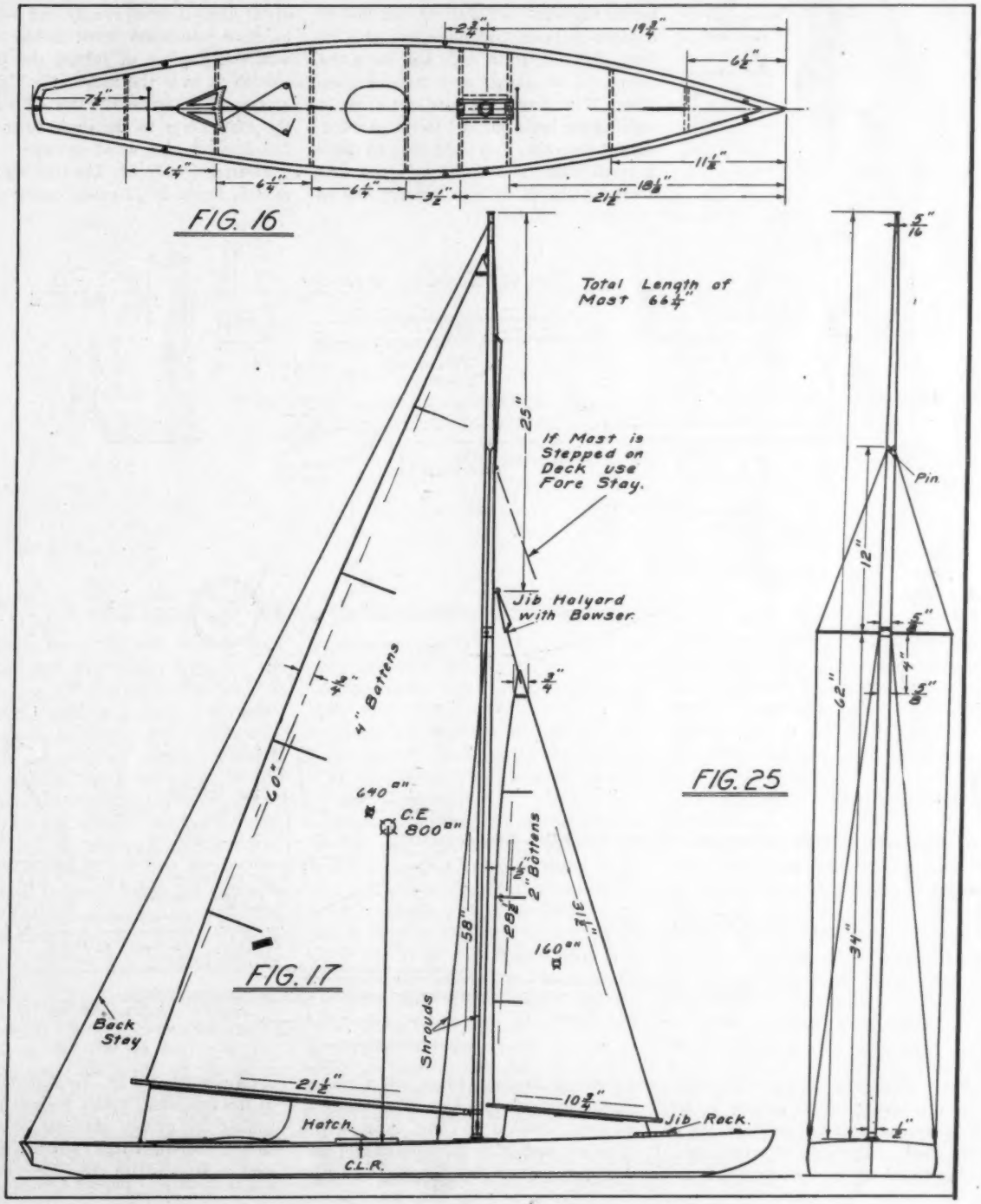
The Rudder. The rudder blade may be made either of wood or of metal. The wooden blade has a slight advantage in that its tendency to float reduces friction. For one having metal-working equipment, the metal blade is much easier to make. For either type of blade, the stock should be made of 3/16-in. O.D. brass tubing with heavy walls. If the blade is of wood the stock should be drilled for the No. 20 by 1¼-in. brads by which the stock is fastened to the blade. The heads should be countersunk slightly and then rounded off with a file. If a metal blade is used, bend 26-gauge nonrusting sheet metal around the stock, and solder the blade to the stock. The rudder is attached to the bottom of the boat as shown in Figure 24.* To prevent the port from turning, a small plate should be soldered to the top of the rudder port by which it may be fastened to the deck, as shown in Figure 32.

*See page 119 April issue.

The Stand and the Final Hull Paint. Before the final finish is applied to the hull, a stand should be made, as the necessary fitting of the cradle blocks is apt to mar the paint. The cradle blocks of the stand should be well padded to protect the hull from mars later on. The stand is usually made of hardwood and finished naturally.

Enamel or some good marine paint should be used to finish the hull. The easiest way to determine the water line is to place the boat in a tub of water and mark very accurately at a number of places the exact surface of the water. It is customary to extend the underwater paint, which is of a different color than that of the rest of the hull, at least ¼-in. above the actual water line. In this case, since the rigging has not yet been attached, it should be extended about ⅜ in. above, and slightly higher in front than in back.

The Spars. For spars choose good straight-grained spruce. Figures 25 and 26 show the details of the mast. The aft edge of the mast to which the mainsail is attached is shaped perfectly straight. The details of the boom are shown in Figure 27, and those of the



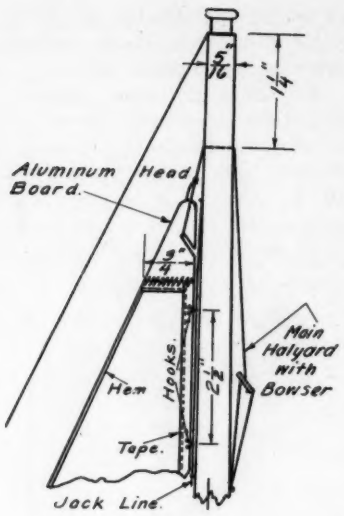


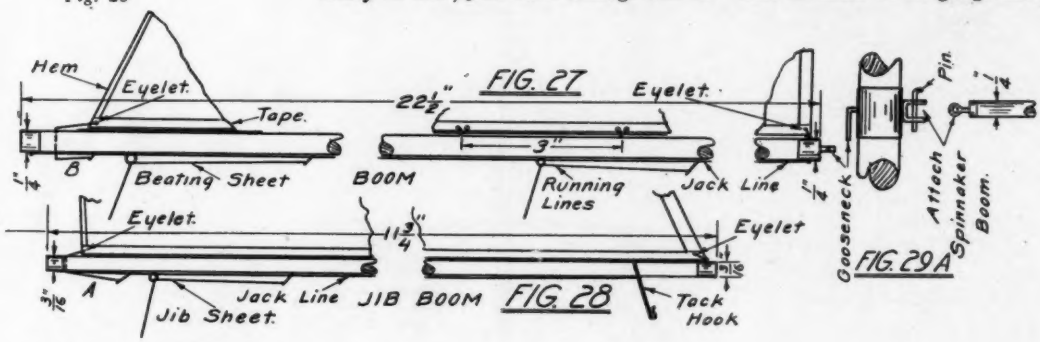
Fig. 26

lines may be attached. A very good and very simple gooseneck may be made by using a piece of tubing the proper size to fit the mast and soldering a hook to it (Fig. 29A). The hook fits into the hole in a metal piece driven into the mast end of the main boom. Figure 29B shows a gooseneck with an extension to keep the boom from skying. It is very easy to make. Solder a piece of ⅛-in. I.D. tubing ¾ in. long to a piece of ½-in. I.D. tubing the same length into which the mast is fitted. At one end of a piece of ⅛-in. rod some 4½ or 5 in. long, drill a 1/16-in. hole and cut a slot about ¼ in. deep. with a hack saw. Then 1 in. from the saw cut make a right angle bend parallel to the saw cut, and at the other end bend over to make a small hook. The ⅛-in. rod must turn freely in the ⅛-in. I.D. tubing. Out of will prevent the boom from splitting. When the boat is completely rigged, attach a rubber band to the boom and the gooseneck extension. A few trials will determine the tension necessary to keep the boom from skying. This device works especially well because it swings with the boom.

The spreader arms are made of ⅛-in. brass rod flattened at one end where small holes are drilled for the shrouds to pass through. The other end of each of the arms is fitted snugly and soldered in place into holes bored in the collar, which is a piece of tubing the proper size to fit over the mast (Fig. 30).

Attaching the Mast Plate. To fasten the mast plate to the deck beams, use No. 3, ⅜-in. f.h. wood screws.

Steering Quadrant. The steering quadrant is made of 22-gauge metal cut as



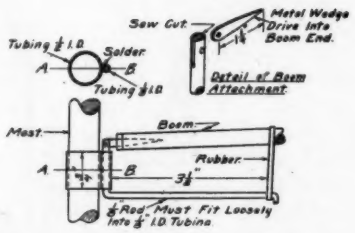


Fig. 29B

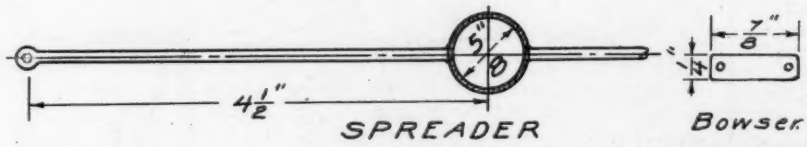
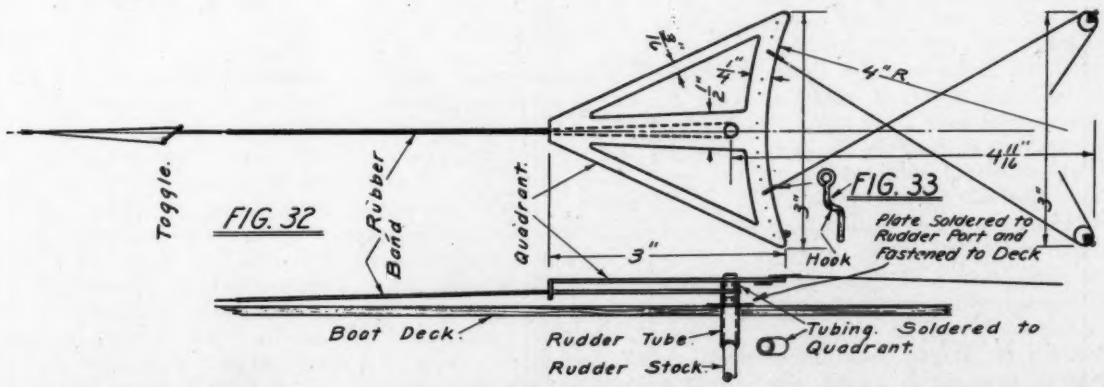


Fig. 30

Fig. 31



jib boom in Figure 28. Attach a short length of brass or copper tubing to each end of the main and the jib booms as shown, and to them solder small hooks or eyes to which the sail and the jack

a piece of 20-gauge brass, cut a wedge-shaped piece about ⅛ in. wide and 1¼ in. long. Drill a 1/16-in. hole at the large end and drive the pointed end into the mast end of the boom. The collar

shown in Figure 32. To the under side of the quadrant, solder a short piece of tubing the proper diameter to fit very snugly over the rudder stock. The quadrant is attached to the rudder stock by

means of a small pin for which a hole is drilled through both tube and stock. A series of small holes ¼ in. apart are bored in the quadrant for the running-line hooks.

The Sails. Sails may be made of longcloth or lightweight preshrunk sailcloth.

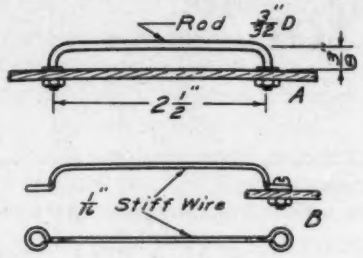


Fig. 34

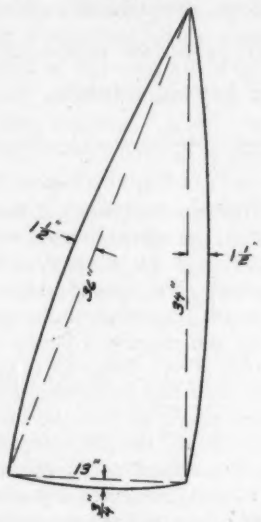


Fig. 35

The laying out of the sails must be done carefully and accurately. Lay out the material on a flat, even surface such as a drawing board or a piece of plywood, and hold it in place with thumbtacks. Lay out the sails as triangles, drawing first a straight line from vertex to vertex. Then add the roaching to the leech; a ⅛-in. outward curve to the luff and the foot of the mainsail, and a ⅛-in. outward curve to the foot of the jib. This small outward curve on the sails permits them to belly out somewhat instead of being straight. The selvage of the cloth should run parallel to the leech.

Since the luff and the foot are to be bound with cotton ribbon tape, they are cut on the line as laid out, but allowance must be made on the leech for a narrow hem of about ⅛ in., and for a double hem on the head where extra strength is needed where the sail is fastened to the headboard.

Small eyelets should be placed at the tack and the clew of both mainsail and jib to take outhauls and lacings. Battens for both sails are best made of celluloid strips 3/32 in. by 3/16 in., and the required length as shown in Figure 17. They are held in place on the sails by pockets made of tape ½ in. wide stitched to the sails at regular intervals. The leech end of the pockets is left open so the battens may be inserted and then a few stitches put in to keep them from coming out. Small hooks, such as are used by dressmakers, should be sewed to the luff and to the foot of the mainsail. The jack line is passed through these and then through small screw eyes on the mast, so that the sail is firmly attached to the spar. These hooks are not necessary on the jib since it is attached to the jib boom only at the tack and the clew.

Rigging the Ship. Along the aft side of the mast and the top side of the boom, arrange a series of small screw eyes, or staples, spaced about 5 in. apart, through which the jack line is passed in attaching the sails to these spars. The mast jack line extends from the top of the mainsail to 1½ in. above the gooseneck. These jack lines are made of stainless-steel wire. The jack lines under the main and jib booms, which are used in adjusting sheet bowsers, are made of cord or fishline. These should have a bowser at one end to hold the desired tension.

Shrouds and stays, when of strong cord or fishline, should all have bowsers to hold the tension. If wire is used, turnbuckles may be used instead. Chain plates may be screwed to the edge of the deck into the hull, or screw hooks, spaced as shown, may be used for fastening the shrouds (Fig. 16).**

Halyards may be made of strong fine cord or of fishline. Bowsers are again used to adjust the tensions.

Running line blocks must have free turning sheaves. The blocks may be attached to the deck with ⅛-in. bolts. This is not a difficult procedure as the hatch is sufficiently large so that a good-sized hand may go through easily (Fig. 20). Running line hooks are made of 1/16-in. stiff wire and bent as shown in Figure 33. For the sheets and the running lines, use light, strong fishline.

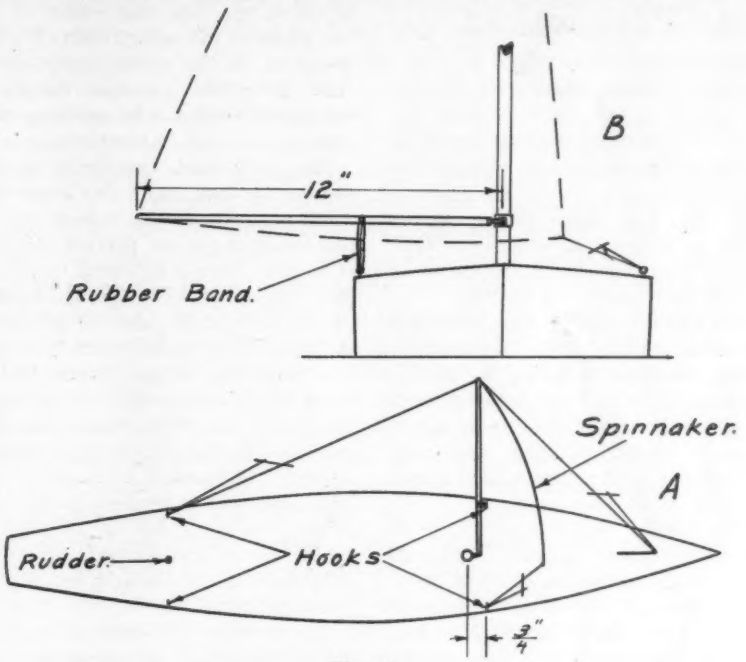


Fig. 36

If jib steering is desired, the arrangement shown for the mainsail may be duplicated.

Spinnaker. The spinnaker is an additional triangular sail used when sailing before the wind. According to the 1935 rules, the spinnaker has only two restrictions attached to its use, namely, that its boom must not extend beyond 12 in. from the center of the mast, and the height of the spinnaker is limited to the top point of the forward triangle. These meager restrictions permit a great deal of leeway in the shape and the rigging of the spinnaker. Since each design has its own pecularities under weather conditions, various spinnaker arrangements should be tried out on a

**See page 147.

new model to get the most efficient sailing combination.

The spinnaker is essentially a bellying sail and therefore all the edges should be cut with considerable outward curve. Figure 35 shows a spinnaker design which may help as a suggestion.

As a rule, the spinnaker is made of lighter material than the regular working sails. The same material of a lighter weight, or silk of the proper weight, may be used. Figure 36 A and B gives some suggestions for rigging the spinnaker.

Securing Public Approval for the School Printshop

Bert Popowski

Central High School,
Aberdeen, South Dakota

An article showing how the facilities offered by a small school printshop were used in solving difficult problems which at first seemed beyond solution.

With the taxpaying public scrutinizing every monetary outlay made by the public schools, it is no wonder that many vocational instructors have been driven to a desperate defense of their work to continue the subjects on which depend their bread and butter.

The Central High School printshop, Aberdeen, South Dakota, has been justifying its existence during the past 21 years by doing all the printing required by a school system that has grown to seven elementary schools, two junior high schools, and a senior high school, in a city of 18,000 population.

The various forms required by the school systems are systematically numbered and mounted in a "form book," a volume that carries more than 300 forms at the present time. This helps to keep a check on all forms, obsolete ones being promptly replaced as new ones are developed.

Whenever a particularly intricate form, usually one that calls for a great deal of cross ruling, is encountered, a supply in excess of the requisition is run, and stored, so that a sudden demand for additional amounts of it can be filled. This is hardly wise for forms that are still in the process of development, since defects in the original forms frequently necessitate a complete revamping of a subsequent order, but where a form has been in use for some time, an over-run on it is rarely wasted.

During the days when the coffers of the various school activities were kept filled by the generous support of the public the school newspaper was composed and printed commercially, the journalism classes being charged only with the collection and writing of news items and the soliciting of sufficient advertising to balance the budget.

The machine composition is still done commercially, but student journalists, who are printing graduates, now set headlines and ads, and make up the four pages of the weekly sheet. A slight change in the size of the paper has enabled the school presses to handle it, the paper being printed one page at a time on a 12 by 18 platen press.

The paper stock (newsprint now instead of the book paper that better days afforded) is cut to size, folded, and the two inside pages are printed first, one at a time. Then it is turned inside out, page four is run, to be followed by page one as the deadline hour forces the last and most recent news stories to a close.

Perhaps the largest single unit of every year's work consists of the school yearbook, the *Arrow,* which has been published by the printshop for the past 13 years. The book is a volume of some 150 pages and is handset in the shop, printed on a 12 by 18 platen press, folded, bound, and covered, by the 150-odd students that annually enroll in the printing courses.

In routing the school yearbook through the shop, certain definite regulations are rigidly adhered to. The staff is chosen early in the school year and responsible positions on it are given to students that have served capably in minor capacities on preceding staffs. The editor-in-chief is made responsible for the assembling of plans for division editors, planning page order, and making up division dummies.

A staff meeting, with the printing instructor, converts these tentative plans into more permanent ones, the theme of the book being considered in carrying out a uniform scheme of division arrangement. After all preliminary plans have been carefully boiled down, dummies are made to show final size and arrangement. A master dummy, which contains all information on sequence of pages, type and halftone areas for individual sections, also is made. This also shows the approximate dates on which copy and photographs for the various sections are due.

Division editors scrutinize this master dummy with extreme care, because it contains the directions which they must follow. When everything has been decided upon, the editors proceed with the accumulation of the necessary copy and photographs. The master dummy remains in the possession of the printing instructor and serves as a final reference in the case of any difference of opinion.

In the event that a yearbook is to have numbered pages, as was the case with the 1935 *Arrow,* the page numbers can readily be indicated on the dummy, but unless one has published a yearbook in a school shop before, numbering the pages is not recommended on an initial venture. The dummy is also indicative of the pages that are paired up when locked for the press; that is, if four consecutive pages bear the same key number (number 24, let us say) the first and fourth of those pages are mates, and the second and third pages will be run together. When printed, folded, and wrapped in a bundle, this same key number will be used to indicate the position of that "signature" in the completed book. When laying out the bundles of signatures, preliminary to gathering them into complete books, such key numbers are found much less confusing than labeling the bundles with data on the contents of the four pages, or, in the case of division or subdivision pages, using the name of the division.

Following such a master dummy is well-nigh impossible unless the division editors understand that copy for pages 1 and 3 of a four-page form are useless, as is copy for pages 2 and 4; the proper mating of these pages, as is indicated

(Continued on page 152)

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

Requisition Time

The annually recurring, often troublesome, and frequently exasperating requisition time is near at hand. Much of the drudgery of requisition writing may be removed if the task is systematically attacked.

In the school-shop field, requisitions may be divided into three divisions: (*a*) Those for supplies needed for carrying on the shopwork, (*b*) those for repairs and replacements, and (*c*) those for new equipment. It is self-evident, of course, that before making any kind of requisition, the budgetary limitations must be studied. Besides this, the writer of the requisition must be prepared to justify the presence of any and all items on his list.

While most of the things requisitioned will be of the common, everyday variety, yet there will be times when the teacher will have to requisition things about which he is not entirely informed. This will be the case especially when new equipment of the major type is to be ordered. The teacher who reads, or at least scans, the advertising pages of THE INDUSTRIAL ARTS AND VOCATIONAL EDUCATION MAGAZINE from month to month, will be better informed than the teacher who considers the advertising pages merely a necessary evil. The fact that the advertising pages record the progress made in providing the school shops with up-to-date supplies, replacement parts, and equipment must not be forgotten nor overlooked. But the advertising pages do even more than this — they keep before the readers the names of dealers and manufacturers who have studied the school-shop field, know what it needs, and are not only ready to furnish the necessities, but are willing to offer more than the usual amount of service usually extended to the customer.

The school-shop field is particularly fortunate to be served by firms that take a broadminded, public-spirited attitude toward the school and the shop teachers. Many offer an unusual amount of engineering, consultation, designing, and research service free for the asking. They are in business, of course, and frankly bid for the orders emanating from the school shop, that is why they advertise in the shop teachers' professional magazine.

The teacher who has been foresighted enough to have kept in touch with the market that furnishes his material, supplies, and equipment, will find that the writing of requisitions is not such a drudgery as some would make it appear. For the rest, it is recommended that they too, begin studying the advertisements which appear monthly in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION. They will find these pages of the magazine filled with a mass of interesting information which will prove helpful to solving many school-shop problems which, up to now, may have baffled the teacher, and they will learn the names of many men and firms that have done much in making possible the fine work accomplished in the industrial-arts and vocational-education classes the country over.

Vacation Time

With vacation time approaching, the conscientious teacher will want to forewarn and forearm the young people who have been under his care during the semester just past, against some of the dangers which will surround them during a period of the year when they will spend most of their time in unsupervised and unorganized activities.

There must be the usual warnings against incautiously crossing a road, playing on the streets and highways, hitching rides, playing with fire, incautiously handling firearms and explosives, taking chances in the water, rocking the boat, flying kites near electrical transmission wires, and of thinking that only dangerous and rough games are interesting. Attention must likewise be called to the need of observing safety precautions while playing games, taking care of even little injuries, treating sunburns like other burns, knowing how to put out campfires, being cautious when handling knives and hatchets, catching fish — not human beings — with fishhooks, avoiding poisonous plants and berries, washing one's hands before eating that picnic lunch, and of carefully choosing the water one drinks.

There is still another duty that the shop teacher can perform with his students in anticipation of vacation time, and that is to interest them in the question of conservation of plants, shrubs, trees, and wild life in general. It is well to emphasize the need of preserving our natural beauties if we and future generations are to enjoy them. This can be accomplished, if everyone becomes cognizant of the fact that only irreparable damage can result if plants, bushes, trees, and the wild life in general, are wantonly destroyed. To prevent this calamity, the student must be led to refrain from killing beneficial birds and animals, from destroying trees and plants, and to be taught how to use with judgment those spots of natural beauty that still remain.

It may be interesting to the lovers of bird life, that the Inland Bird Banding Association, Chicago Academy of Sciences, 2001 N. Clark St., Chicago, Ill., is engaged in making a new method of study to learn how long birds live, what routes they follow in migration, how many miles they travel in a day, whether or not they return to the same place, whether or not they keep the same mate, and many other interesting facts. Members of this organization, both in the United States and Canada, have so far placed aluminum bands on over 2,000,000 native birds. They ask those who find or handle any game bird or any other bird, dead or alive, to examine its legs for a band. Should it be banded, read the number, with extreme care to read it correctly. If the bird is alive, leave the band on, and release the bird, but if it is dead, remove the band. Send the number noted or the band removed, and all possible information, to the National Parks of Canada, Ottawa, Ont., Can., if the bird is found in Canada, or to the United States Biological Survey, Washington, D. C., if it is found in the United States.

About 3 per cent of the birds banded have already been heard about and some of the information obtained by this new method is very interesting as is shown by the following excerpts from the findings of this Association. A hunter in Trinidad, West Indies, returned a band from a bluewinged teal duck that had been banded 76 days earlier about twenty miles north of Toronto, Ontario. A native found a banded bird on the Niger River in Africa. He took it to a missionary, who sent it to the United States Consul, and at length was informed that it was a common tern which had been banded on the coast of Maine, four years earlier. An arctic tern, banded on the Labrador coast, was found on the east coast of Africa. A common tern, banded in Saginaw Bay, Lake Huron, was found at Trujillo, Peru, 500 miles south of the equator.

Preparing the young for their vacations by a few talks on the subjects just mentioned, will help the teacher extend his range of influence far beyond the confines of his shop, and may add materially to the benefits and pleasures which his pupils will derive from their vacations.

SECURING PUBLIC APPROVAL

(Continued from page 150)

in a preceding paragraph, is 1 and 4, and 2 and 3. A school shop containing a limited supply of body type must plan on setting type matter for mating pages only, otherwise type will be tied up in setups of pages that cannot be run.

Perhaps the greatest remaining obstacle in the way of a yearbook produced in the school shop is the one of uniform ink color. The writer struggled with this problem for a couple of years before the solution presented itself. Then he fell into a foolproof method. Thoroughly trustworthy students are appointed to supervise the work of each press crew. A grand prize is then awarded at the end of the year to the press crew that has turned out the best work. The points awarded must be so distributed as to penalize the speedy running of a job at the sacrifice of quality. The ink is best applied to the ink plate with a brayer, having previously been worked out to a suitable "leanness" on a piece of plate glass.

Other factors conducive to a quality job are a perfectly level platen, hard packing (a detsul tag stock being sufficiently hard, and much less expensive than pressboard), a quality tympan paper, a high-quality halftone ink, and a gloss book paper for the body of the book. The few cents that one can save in buying a lower quality ink is almost always a false economy, while a dull-finish book paper can give any amount of trouble to beginners. In the hands of expert pressmen, a dull finish paper will give as good or better final results, but it is hardly to be recommended for student use, the amount of ink and impression both being tricky and uncertain ingredients in the recipe for a quality job.

The amount of printed matter in the average high-school yearbook may appall the uninitiated, but it is surprising on what meager equipment one can produce excellent results. For instance the 1935 *Arrow*, a volume of 148 printed pages, was produced from the following equipment: one 25-pound font of 10-point Century body type, five pounds of American line leaders, eight pounds of 30-pica leads, two fonts of 12-point Bernhard Gothic medium, including capitals and lower case, one font of 18-point Bernhard Gothic medium capitals, and the usual supply of spacing, reglets, quoins, and furniture. The books were printed on a 12 by 18 platen press, only two chases being used, interchangeably, in locking up all of the forms. All the stock was cut to 11 by 16 in., two pages being printed at a time.

In organizing the press crews three students to a crew are enough; one to feed, another to watch ink color and apply ink, and the third to strip off the stock for the feeder or to "slip-sheet" as necessity arises. It is usually wise to provide an alternate to each crew, a regular crew member losing his place to the alternate upon being absent for one or more days. It is surprising how much effort such a crew will exert to keep its personnel intact, and how much competitive spirit a daily posting of the earned merit points will develop.

Perhaps the memories dearest to the hearts of the crew members are the coups counted "when Red 'n me 'n Bob ran off this section," or "remember how we got the most points for keeping the ink up on this run?" Crews frequently reserve a certain page in the book on which to collect the autographs of their teammates when the books are received.

No printing instructor can afford to overlook the amount of publicity that such competition engenders, the student interest in such a project compelling parental attention and comment, all of which advertises the shop and its product in a highly favorable light. Publicity of this sort concentrates student, parent, and community interest, and when enough such interest is aroused, the fears that an instructor may lose his pet vocation because his particular subject is taken out of the curriculum, are unnecessary.

Problems and Projects

A METAL DESK OR TABLE LAMP

S. H. Puehler, Milwaukee Public Schools, Milwaukee, Wisconsin

In choosing the material for the project described herewith, first determine the size of the circle desired and the purpose for which the lamp is to be used. Either brass or copper tubing may be used. The length of tubing needed will be determined by the size of shade obtainable and by the type of design selected. Either a whole or three-quarter circle may be used in designing the lamp. The latter is likely to be more desirable for desk purposes.

The tubing can be bent around some cylindrical object of the correct size, or if several lamps are to be made, a circle may be cut from a ¾-in. board.

If a full-circle design is desired, cut off the tubing with a hack saw so that its ends lack ¾ in. of meeting each other. Care must be taken not to clamp the tubing too tightly in the vise, as the restoring of the crushed tubing to its original form is almost impossible. File the ends square and remove all burrs formed on the inside and the outside of the tube.

In shaping the ⅛-in. brass tee, one may file off the excess shoulder stock on its opposite horizontal ends, or these shoulders may remain as an indication of added strength and as a variation in the design. The filing can best be done by screwing the tee onto a rod or pipe properly threaded. The file marks must then be removed with emery cloth.

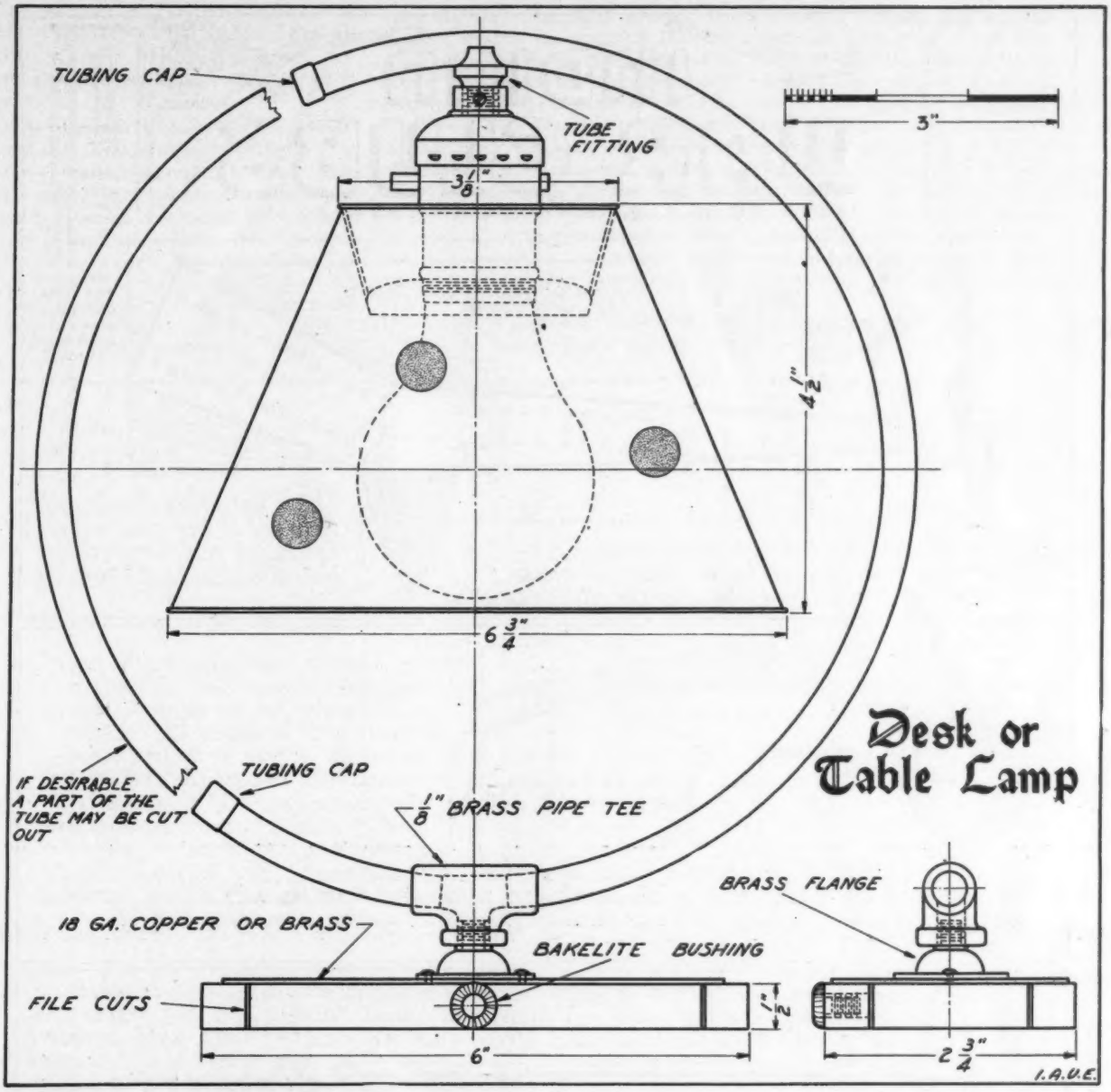
Table lamp

Next, bore out of the horizontal ends of the tee with a ⅜-in. drill. Then coat the inner surfaces of these drilled holes with a liquid solder, insert the tubing into the tee ends, and line up the hole for straightness. Place the joint over the flame until the solder is melted and the joint has been made.

This same operation may be accomplished by sweating. This is done by heating the assembled parts above the melting point of solder. Apply a liquid flux to the joints and hold some wire solder against the adjoining parts where the tubing enters the tee. As the solder melts it will be drawn into the inner surfaces by capillary action, thus making a tight joint.

The socket connection is next filed with a round file to fit the tubing. One of several kinds of fittings may be used for this purpose. Coat surfaces of both parts with solder, line up with the vertical stem of the tee, and sweat together over flame.

For those who would rather make a desk



lamp with the tubing, making ¾ of a circle, cut off the tubing as shown in the illustration, and solder caps over the ends. Care must be taken in this process of soldering to prevent the parts already soldered from coming apart. This can be prevented by wrapping the tee with a wet cloth.

The lengths of ½-in. square mild steel for the base can be cut and filed to size. Clean the scale from all surfaces by rubbing the pieces back and forth on a sheet of emery cloth. Drill and thread the hole in one of the long side pieces for inserting ⅛-in. bakelite bushing using a 21/64-in. drill and a ⅛-in. pipe tap.

Cut and file to size the sheet of copper, brass, or iron chosen for the top plate. Drill the rivet and center holes needed for the passage of wire and for fastening the brass flange. Clean surfaces with emery cloth.

Clamp the ½-in. square pieces in exact position and coat upper surface with solder. Lay on the top plate and sweat together over a flame. Small grooves may be filed in at the soldered joints and painted black for decorative purposes. Clean, file, and polish the entire outer surface of the base. Rivet on the brass flange.

The lamp may be made as a combination wood and metal project, in which case, the base may be made of some of the finer cabinet woods of contrasting colors. Several holes should be drilled into the base block and these holes should be filled with lead for added weight. This can be done before gluing the thin top board on, thus covering up the inclosed lead.

The entire lamp should then be lacquered, or varnished and waxed. Do not touch any parts to be coated, after the final rub with emery cloth and steel wool. Should anyone wish to spend additional money, he may have his lamp chromium plated. An oxidized finish is also desirable and can be easily obtained by rubbing the copper tubing with a solution of barium sulphide and water, after which the tubing should be rubbed at various places with ordinary scouring powder. A protective coat of clear lacquer is then to be put on.

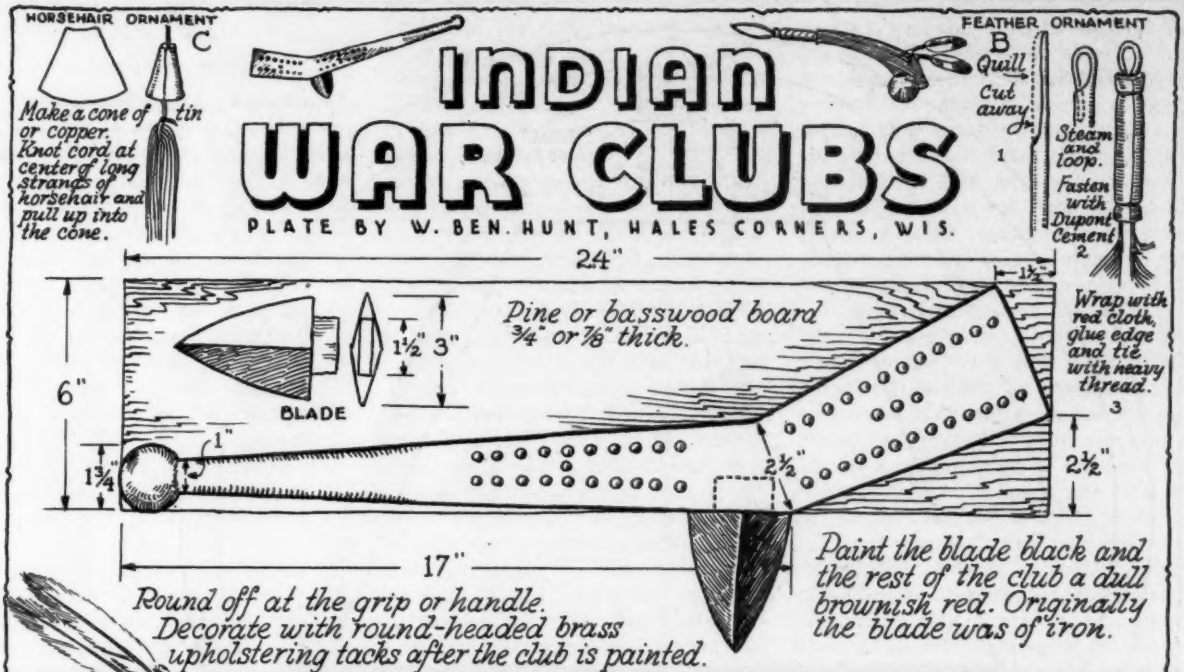
The lamp can now be wired. This operation may take from five minutes to several hours depending on how successfully one can fish the wire through the tubing.

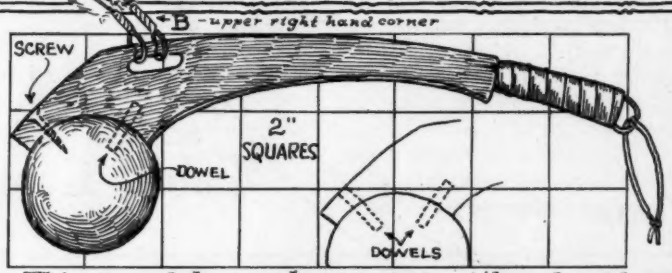
A shade may be procured containing a ring that screws on the threaded part of the socket, or the bulb wires of any shade can be cut in half and soldered onto a shade ring supplied for this purpose.

Screw in a bulb and sense the glow of satisfaction radiating from a really fine accomplishment.

INDIAN WAR CLUBS

PLATE BY W. BEN. HUNT, HALES CORNERS, WIS.

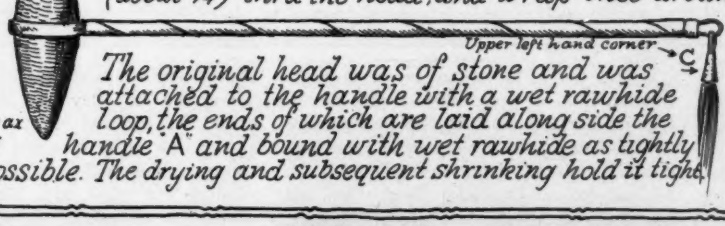

HORSEHAIR ORNAMENT
C
Make a cone of tin or copper. Knot cord at center of long strands of horsehair and pull up into the cone.
FEATHER ORNAMENT
B
Quill
Cut away
1
Steam and loop. Fasten with Duponi Cement
2
Wrap with red cloth, glue edge and tie with heavy thread.
3
24"
6"
1¾"
1"
1½"
3"
BLADE
Pine or basswood board ¾" or ⅞" thick.
2½"
2½"
17"
Round off at the grip or handle. Decorate with round-headed brass upholstering tacks after the club is painted.
Paint the blade black and the rest of the club a dull brownish red. Originally the blade was of iron.



Cut handle from a piece of 1" pine. Use an old croquet ball, about 3" or 3½" in diameter, for the knob. Fasten as shown, with a dowel set in glue and a 1½" screw, or with two dowels, the one at the end being driven in last. If a screw is used be sure to countersink it and cover it afterwards.

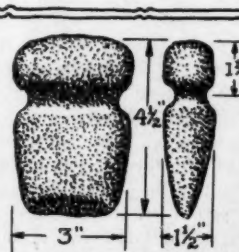
This war club may be painted with red and yellow paint. The handle should be rounded and covered with buckskin, wrapped spirally over a loop fastened with with small nails. Two or three feathers, as shown, complete the job.

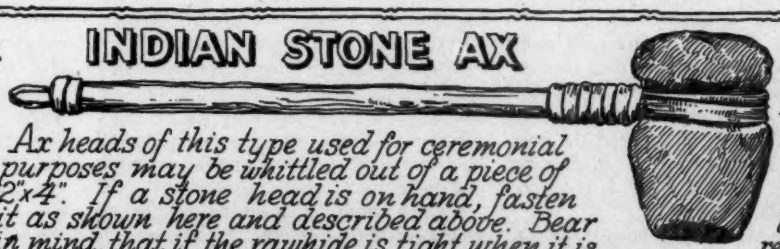
The head is 2 inches in diameter and 5 inches long and can be whittled out of any kind of wood. To fasten the handle, bore a hole the proper size, (about ¾") thru the head, and wrap once around the head with buckskin and also the entire length of the handle. Put a loop at the end to fasten some suitable ornament. Paint the head a brownish gray color to represent stone.



The original head was of stone and was attached to the handle with a wet rawhide loop, the ends of which are laid along side the handle "A" and bound with wet rawhide as tightly as possible. The drying and subsequent shrinking hold it tight.

INDIAN STONE AX





If wood is used for the head, Paint it to look like real stone

Ax heads of this type used for ceremonial purposes may be whittled out of a piece of 2"x4". If a stone head is on hand, fasten it as shown here and described above. Bear in mind, that if the rawhide is tight when it is wet, it will be like iron when it is dry. In the absence of rawhide, bore a hole thru the head and drive the handle in. Then wrap it with buckskin.

THE UNIVERSAL OHMMETER

Gilbert Oberweiser, Milwaukee, Wisconsin

An ohmmeter permits unknown resistances to be read directly in ohms. Thus, for work where the values of a large number of resistances must be determined daily, as, for instance, in checking radio circuits, and in electrical laboratory and test work, the ohmmeter is a timesaver which offers an escape from the more cumbersome and complicated methods of obtaining resistance measurements.

Many resistance-measuring devices require the use of standard resistors. But standard resistors are expensive. The ohmmeter described herewith is designed so that it may be calibrated mathematically close enough not to contain any error over 6 per cent (this 6 per cent includes the possible 2 per cent error of the milliammeter). Further, the ohmmeter is designed to cover a large range of resistances, from 0.5 to 90,000 ohms, which makes it useful for many kinds of electrical work. However, to cover such a large range of resistances adequately, three calibration curves or scales are needed.

Discussion of High and Medium Scales

Since the high-scale and medium-scale circuits of this ohmmeter are the simpler, and also, since these two circuits can be made to show the fundamental theory underlying the operation of the ohmmeter, they will be discussed first. Figure 1 is the simplified electrical drawing of these two scales, in which (Rb) is the battery resistance, (Rm) the resistance of the milliammeter, (Rx) the unknown resistance and in which (Rv) is identical to $(R3 + R4 + R5)$ of the medium scale circuit and $(R3 + R4 + R6)$ of the high scale circuit. (See circuit diagram shown in Figure 3.)

This, then, is a simple series circuit operating according to ohms law; that is,

$$I = \frac{E}{Rb + Rm + Rv + Rx}$$

To calibrate these scales, adjust (Rv) so that the milliammeter is at full-scale deflection (5 *ma*) when (Rx) is zero. Doing this will cause any unknown resistance (Rx) that is introduced into the circuit to give a definite reading on the meter.

Since the voltage of the battery is fixed (5 v.), and since $(Rb + Rv + Rm)$ must always be the same to allow 5 milliamps to flow in the circuit upon adjusting it, these values will appear as constants in the calibration formula.

The medium-scale calibration formula is:

$$I = \frac{4500}{900 + Rx}$$

The high-scale calibration formula is:

$$I = \frac{45000}{9000 + Rx}$$

Points along the curves (Figure 4) are then found by assuming values for (Rx) and solving for (I).

(I) in these formulas is the current in milliamperes.

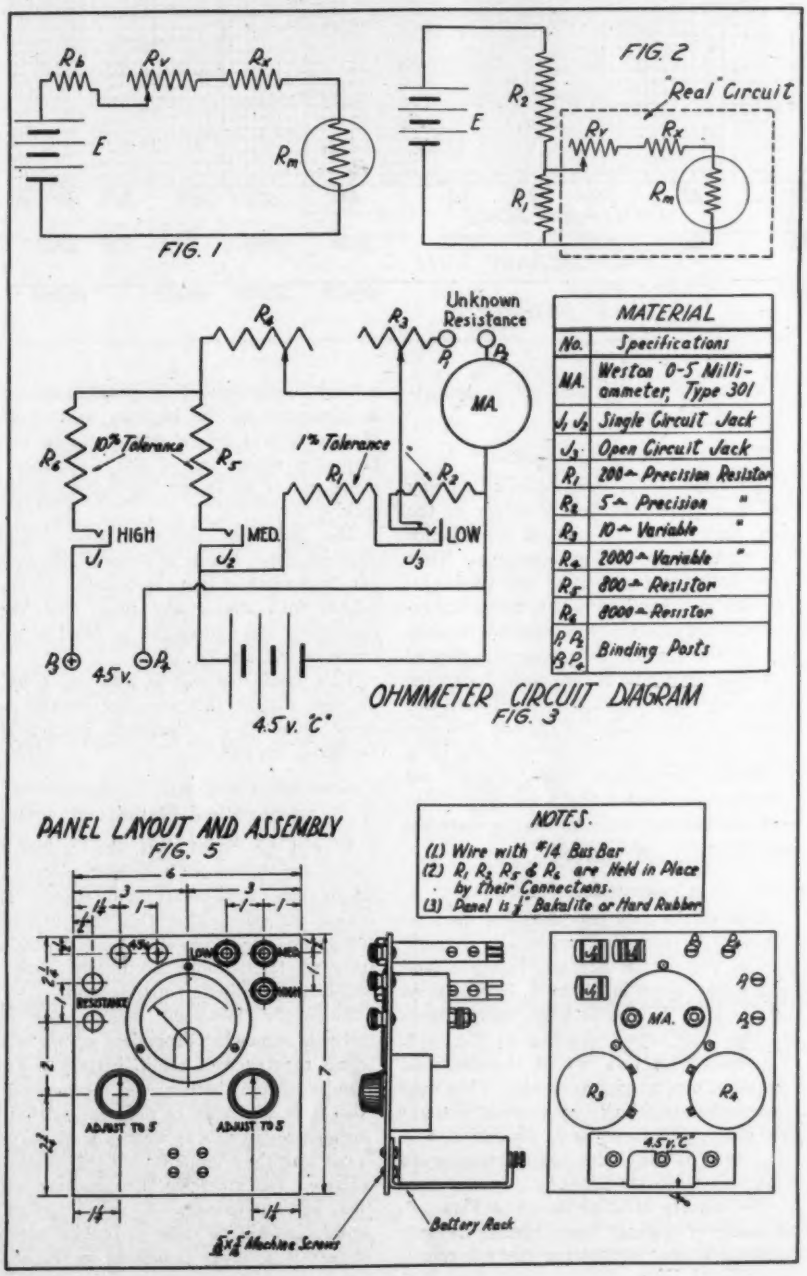
A great advantage lies in that the age of the battery (the increase in internal resistance due to polarization) will have no effect upon the accuracy of this instrument, because any change in battery resistance will be compensated for by readjusting the variable resistance (Rv) when adjusting the ohmmeter for operation. Thus, the accuracy of the medium and high scales of this ohmmeter will depend only upon the accuracy of the milliammeter. The meter specified in the drawings (Weston 0–5, Type 301) is rated as being accurate within 2 per cent.

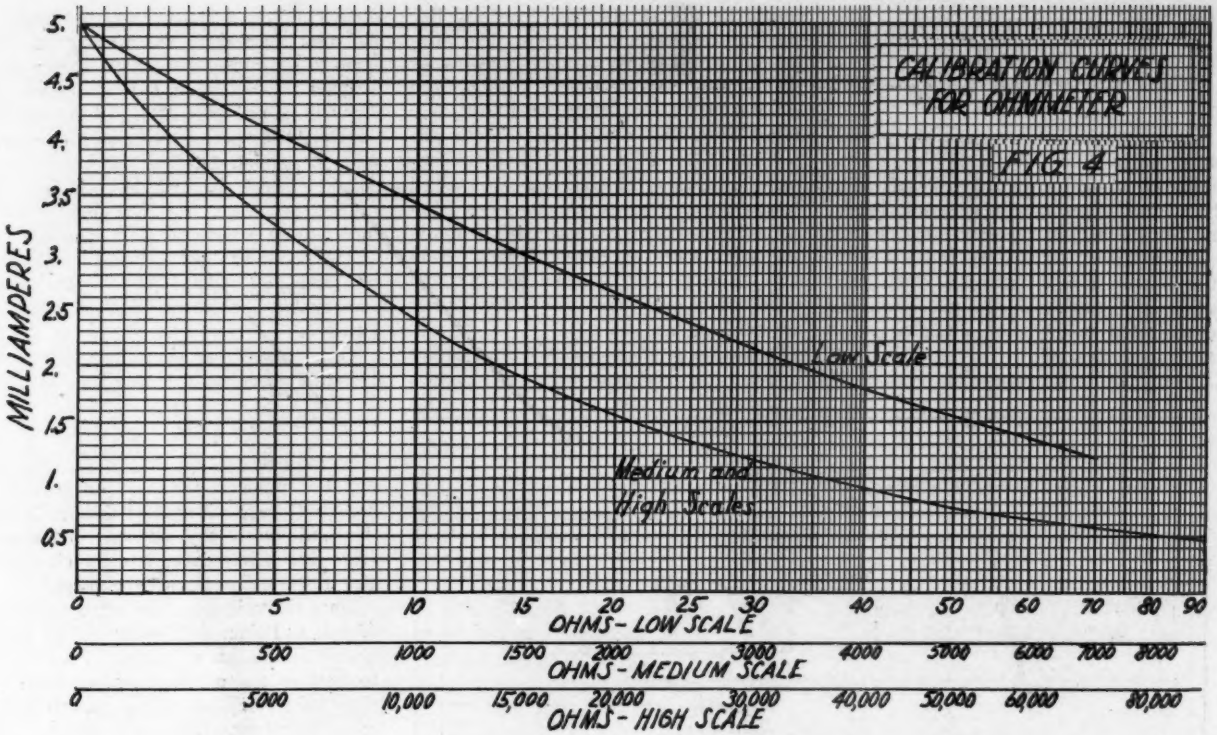
In the circuit drawing of the ohmmeter, the function of $(R5)$ and $(R6)$ is that of protecting the meter from serious overloads while readjusting $(R3)$ and $(R4)$ for the use of different scales.

Discussion of Low-Scale Circuit

Figure 2 represents the electrical circuit of the low scale where $(R1)$ and $(R2)$ is the voltage divider, and where the parallel branch across $(R2)$ can be considered as the "real" circuit.

The theory and calculations of the cali-





bration curve here is a bit more involved. And the reason for this more complicated circuit is that it is necessary to produce a low voltage across the "real" circuit if low resistances are to be measured with any accuracy.

The complexities that the voltage divider introduces are:

a) The circuit becomes series-parallel.

b) The voltage across the "real" circuit (parallel branch) is not constant, and this must be taken into account.

c) The change in battery resistance due to age is not directly compensated for as it is in the simple circuit.

d) The resistances (*R*1) and (*R*2) must be the precision type specified in the circuit drawing, for cheap resistors here will seriously hazard the accuracy of this scale.

The formula derived from calculating the points along the low scale curve is

$$I = \frac{22{,}500}{200\,(22.07 + Rx) + 5\,(17.07 + Rx)}$$

where (*I*) is the current in milliamperes.

It must be remembered that since this is a special equation, it holds true only as long as the specifications in the circuit drawing of the ohmmeter are followed. That is, if (*R*1) or (*R*2) differ from the values specified, the calculated curve will be off its course.

However, due to the fact that even precision resistors are not perfect, a small error will creep into the calculations because of the 1 per cent tolerance the manufacturers allow for these resistors. The maximum error in this case will be approximately 4 per cent.

Switching Apparatus

This ohmmeter is designed in such a way that it may be switched to either of the three scales with the greatest convenience but with the minimum apparatus. Thus three ordinary radio jacks are used (J1, J2, and J3), each of which keeps its respective circuit open. (See Fig. 5.) To close any of the circuits then, insert a *shorted* jack plug into any of the desired circuits. Since only one plug is to be used with this apparatus, the danger of closing two circuits will be eliminated, and since the jacks in Figure 5 are labeled "High," "Low," and "Medium," even one who is not acquainted with the ohmmeter circuit may operate the apparatus.

Construction Notes

Most of the data necessary for the construction of this measuring device is specified of the circuit diagram, Figure 3, and with panel layout in Figure 5. However, no reference to the size of holes, etc., is made on the panel-layout drawing in Figure 5. The reason for this is that the sizes and shapes of commercial parts vary. Thus only their center positions (positions of shanks) are given, and these being dimensioned so that even if the parts are a bit oversize they will fit on the panel.

The battery rack, as shown in Figure 5, is made of 9-gauge sheet metal. Its only purpose is that of holding the 4.5 volt *C* battery rigidly behind the panel, with a ⅛ in. clearance at the bottom, so that the ohmmeter will be in one compact unit. Here the center tap of the *C* battery is made use of to fasten the battery to the rack.

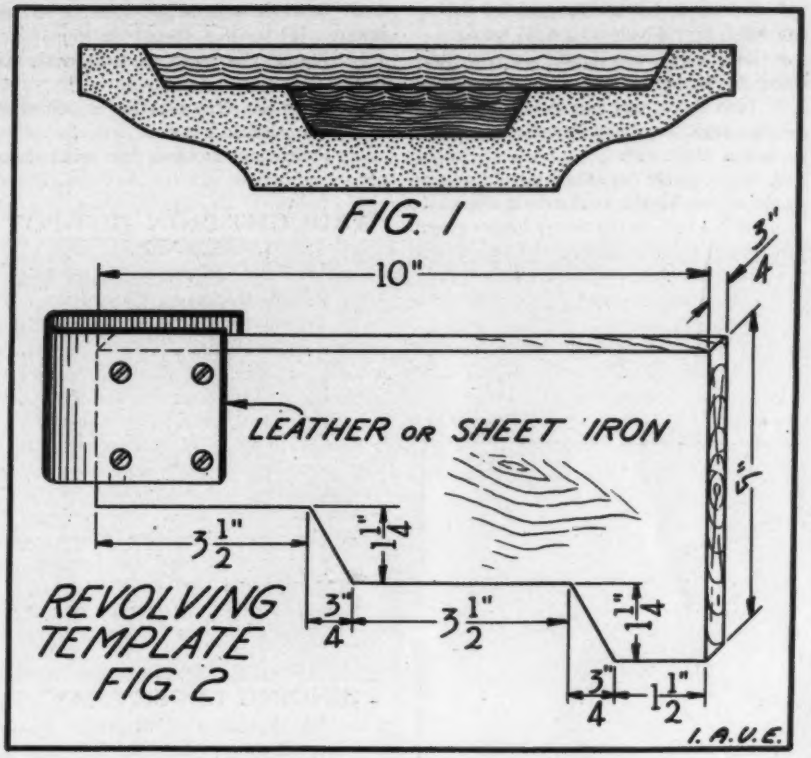
The markings on the panel (High, Medium, Low, Adjust to 5, and Resistance) can be scratched into the bakelite or hard rubber with almost any sharp tool, then the letters and figures can be filled in with chalk or white paint.

This ohmmeter will fit into any 6 by 7 by 4-in. cabinet that does not require any more than ⅛-in. clearance around the border of its panel.

Final Notes

It will be noted that the calibration curves for this meter have been plotted on single-cycle semi-logarithmic paper. The reason for this is that this kind of paper straightens the curves and makes it possible to read them more accurately than if ordinary co-ordinate paper is used.

Since the low-scale accuracy of this meter is somewhat dependent upon the internal resistance of the *C* battery, a good standard-grade battery is recommended. Also it is advisable to note the setting of variable resistor (*R*3) when a fresh battery is put into the ohmmeter and the apparatus adjusted for low-scale use; because after this setting changes a very noticeable amount it will be time to replace the old battery if accuracy is desired on this scale.



A SIMPLE BIRD BATH

George G. Greene, Lane Technical High School, Chicago, Illinois

The bird bath described in this article has two good points: it is easy to make and it has two depths so that small as well as large birds may enjoy it. See Figure 1.

The first step is to make the revolving template shown in Figure 2. It is made of ¾-in. lumber. Fastened to it is a strip of sheet iron so that the template can be held snugly to a ¾-in. dowel or broomstick.

This round stake or pivot is to be driven vertically into the ground and a mass of smooth damp clay or concrete piled around it.

By rotating the template a few times, a perfect core is made for the inside of the bath, as is shown in Figure 3. As soon as this core is hardened, it is painted over with any thick oil or grease. Then a strip of heavy cardboard or a piece of 1½-in. band iron is bent around to make a retaining wall, as shown in Figure 4.

The band iron also may be bent into an octagon which gives a pleasing variation. See Figure 5.

The last step is to saw off the pivot and pour over the core a 1½-in. layer of concrete stiff enough so that it can be molded to shape with the bare hands. Smooth the base with a flat block as shown in Figure 6. After two or three days, remove the band and lift off the bath by gently inserting a putty knife or old chisel in the crack between the core and the bath. If there are holes or other imperfections in the bath, fill them out with a thin layer of rich cement put on with a brush.

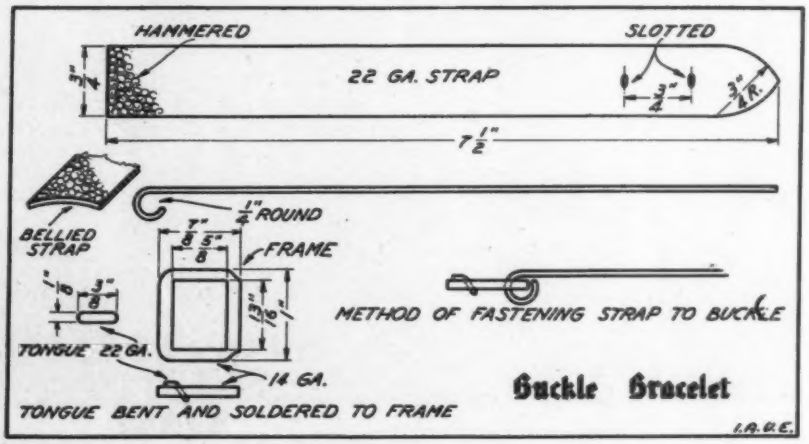
Three parts of sand and one of cement will make a strong bird bath, and any number may be poured if the core is made of concrete.

BUCKLE BRACELET

J. J. Meyer, Montauk Junior High School, New York City

Job Specification

To make a bracelet that is not only novel, but practical. This bracelet can be made of a combination of metals — copper buckle and silver strap, or vice versa; brass buckle and silver, or vice versa.



Materials

1 piece of 22-gauge, ¾ by 7½-in., German silver.

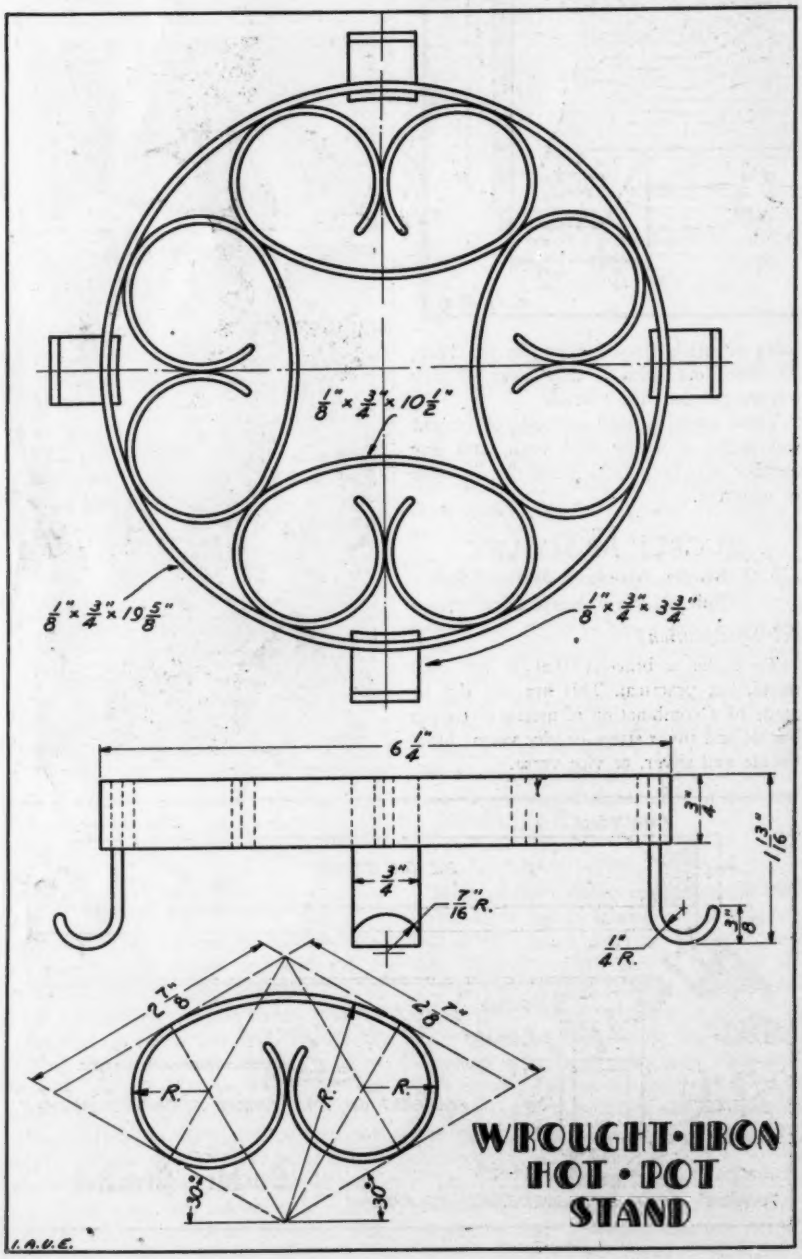
1 piece of 14-gauge, ⅞ by 1-in., German silver.

Tools Required

8-oz. ball-peen hammer; hand drill; ¼-in. bit; rule; pencil; pliers; steel wool; file; soldering kit.

Operations necessary

1. Hammer the German-silver strap in the usual manner.
2. Lay out the slots shown in Figure 1.
3. Lay out the end of the strap as shown.
4. Cut the slots with a small slot punch or jeweler's saw.
5. Cut the end of the strap with a shears, and finish by rubbing with steel wool.
6. Belly the strap lengthwise as indicated in Figure 1.
7. Turn the square end of the strap into a ¼-in. loop. This may be done by curling it over a ¼-in. rod.
8. Lay out the 14-gauge metal for the frame of the buckle as shown in Figure 1.
9. Drill a hole in the center large enough for jeweler's saw, and proceed to cut out the center in the usual way.
10. File the corners of the buckle frame as shown.
11. Lay out tongue of buckle from a small piece of 22-gauge scrap of the same material used for the frame of the buckle.
12. Bend the tongue and solder it to the frame.
13. Fasten the strap to the buckle as shown.
14. Form the strap over the blowhorn or one of the similar stakes.
15. Polish and finish in the usual manner.



WROUGHT-IRON HOT-POT STAND

John J. Frick, Burbank Junior High School, Berkeley, California

This metal hot-pot stand is a popular project among the shop boys in junior high school, for aside from the shop operations in design and forming, it provides a useful home convenience.

It is made of ⅛ by ¾-in. wrought iron. The operations include measuring, hack sawing to length, filing, drilling (no drilling is necessary when spot welding is used), forming and riveting or spot welding. A jig may be used for forming the circular part and the scrolls.

A coat of black lacquer or a coat of beeswax will add to the finished appearance.

AN EASY METHOD FOR BINDING LOOSE LEAVES

Lee M. Klinefelter, Ruffner Junior High School, Norfolk, Virginia

Though the hand binder generally sews a book on tapes or cords, for some types of binding "sewing through" is a more satisfactory method. This method consists of drilling a row of holes through the book close to the back and sewing it together through these holes. This method is particularly suitable for the binding of loose leaves, such as typewritten and mimeographed sheets, the contents of loose-leaf notebooks, and any other similar material that is worth keeping. It is equally suitable for the rebinding of books that have been literally "read to pieces." Such books, having a great many loose leaves, are difficult to bind satisfactorily in any other way. Though especially suited to the binding of these particular types of materials, this method of sewing may be used for binding or rebinding any kind of book or magazine. It is a quick and convenient method of binding together groups of bulletins, drawings, blueprints, and similar material. The main disadvantage is that books so bound do not open as well, nor lie as flat when opened, as those regularly machine or hand sewed. Against this is balanced the great strength of books sewed in this way, and the ease and speed with which this binding may be done.

The first necessity will be a sewing or drilling clamp. A commercial type of clamp, such as is shown in Figure 1, may be bought at moderate cost. It is meant to be screwed to a bench and used with a hand drill, but it also may be mounted on the edge of a board and used under the drill press.

The clamp shown in Figure 2 is very simple in construction. It is meant for use with the drill press but can be set up in the bench vise and drilling done with a hand drill. As you will see, it consists essentially of a cross bar mounted along the edge of a board. At each end a short piece of ⅛-in. pipe is screwed into the angle-iron bar to act as a guide for the two ¼-in. bolts that hold it in place. Along the edge of the bar is a series of holes to guide the drill. The exact construction of the clamp is not important so long as its purpose is kept in mind when making it.

The book or other material to be bound should be arranged in order and jogged up square at the back and head. It is then clamped up with the back square and flush with the outside edge of the clamp. It should be centered so as to leave about the same space between end holes and the ends of the book. Be careful that the back does not bulge out, otherwise the sewing will be so far into the book that it will not open well.

Drill through each hole with a 3/32-in. drill or the equivalent number drill (No.

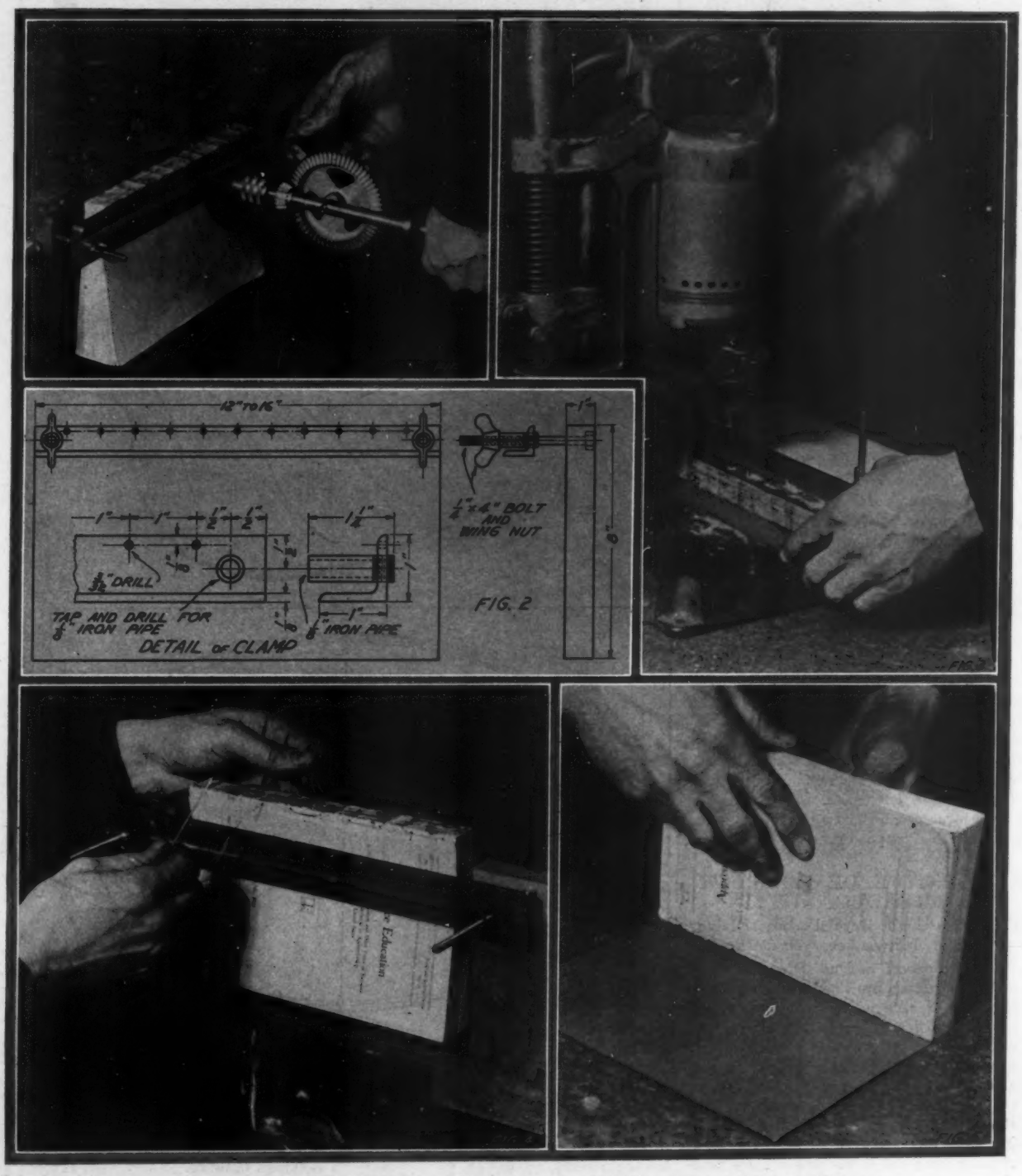


Fig. 1. Commercial clamp in use. — Fig. 2. Homemade drilling clamp. — Fig. 3. Drilling with homemade clamp. — Fig. 4. Sewing the book. — Fig. 5. Gluing on a paper cover

42). Some care may be needed to keep the drill going straight through the book instead of coming out through the back.

After drilling, loosen the screws and slip the back of the book an inch or so out of the clamp. Then retighten and set the clamp and book upright in the vise for sewing.

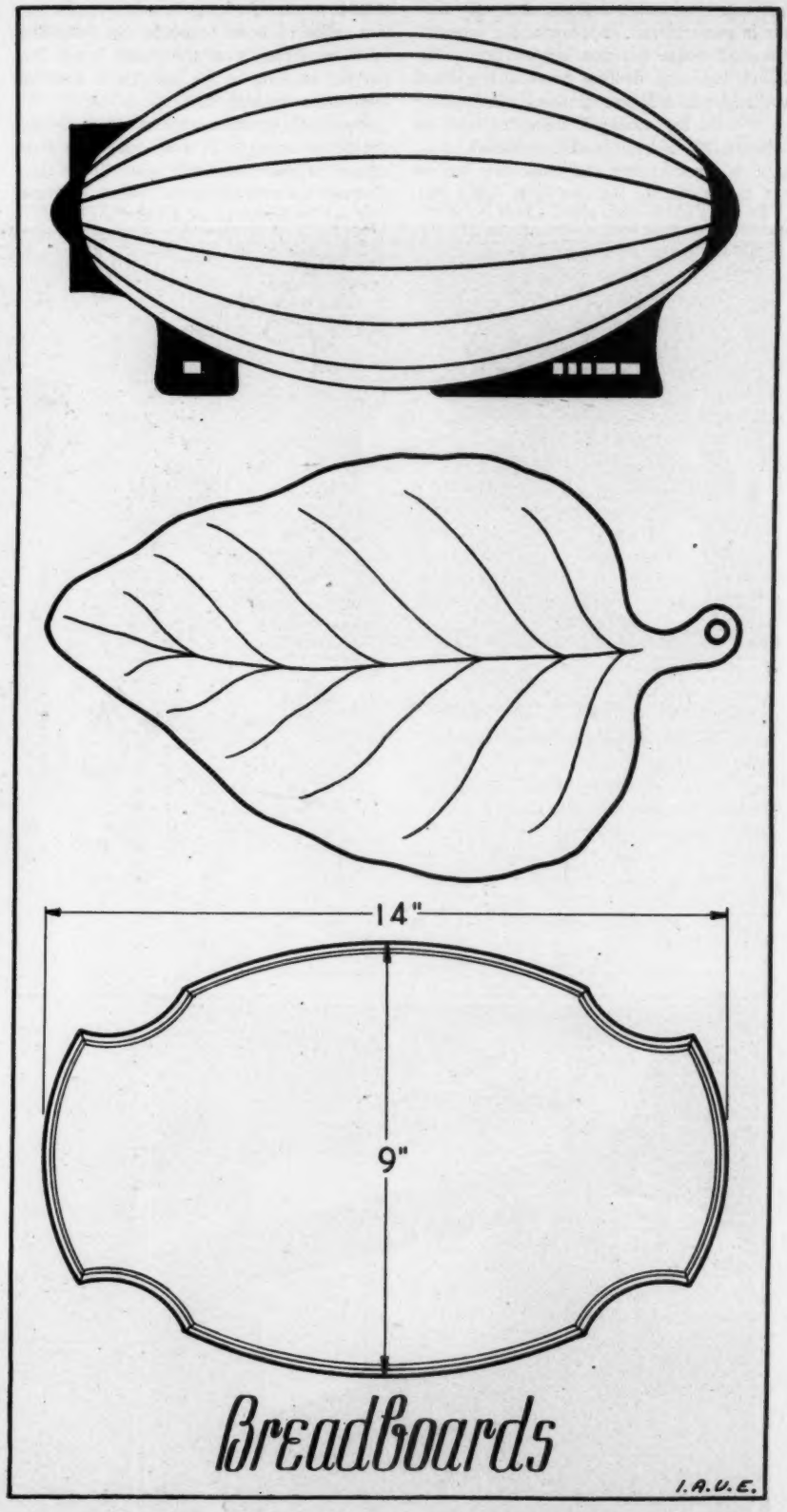
Sewing should be done with a strong linen thread. Hayes No. 18 2-cord thread is a good size and quality. If this cannot be obtained, a satisfactory substitute may probably be obtained from a local dealer in shoe findings. Use a large needle and a double thread about four times the length of the book. For an 8-in. book, the *doubled* strand should be about 32 in. long. Starting at the near end, sew through the end hole and back through the second one. Pull the thread through until only an inch or so is left out on the front. Slip the needle through the knotted end and pull up tight. Then pass the needle back through the second hole and pull the knot into the hole. Come back through the third hole and sew on down the book to the end, and back to the second hole again, where the needle is passed under the first stitch and the thread knotted.

The remainder of the binding depends on the use to which the book is to be put. If it is desired to make a fully bound book out of it, end papers should be applied and the binding completed as for a book sewed on tapes or cords. However, if the value of the material and the use to which it is to be put do not justify a complete binding, a piece of heavy craft or cover paper may be cut large enough to cover the back and sides of the book. After bending it at the hinges to fit the book, the back of the book should be thoroughly glued up and fitted in the center of the cover. The back should be well rubbed down and the book laid aside to dry. While this does not make a book in the strictest sense of the word, it does provide a way of conveniently keeping together and protecting material that might otherwise be separated, lost, or destroyed. At a later date, if desired, the paper cover can be taken off and a more elaborate binding put on.

SUGGESTIVE DESIGNS FOR BREADBOARDS

E. H. Grosskopf, Boys' Technical High School, Milwaukee, Wisconsin

The breadboard designs shown herewith make interesting projects for the grades. One side of each of these boards is well sanded and left in the natural state. The other side is given a coat of raw linseed oil after sanding. After the oil is dry, this side and the edges of the board are finished in enamels. On the zeppelin board, for instance, the ends of the board are finished in silver. The cabins, rudder, and the lines running from end to end are in black, and the rest is left natural. The edges of the board may be enameled to suit the color scheme used in the kitchen or on the kitchen utensils.



When in use, the decorated side of the board is turned down, but when put away in the pantry or kitchen cabinet, this side is turned outward.

Other designs, such as a rabbit, a sunfish, a duck, or an open flower also may be used.

HAIR DRIER FOR GYMNASIUM OR NATATORIUM

Wm. R. Wood and E. A. Rerucha,
Wakefield, Michigan

The drying of the hair rapidly and thoroughly after washing is a problem with which every girl and woman must contend. It is particularly a problem of much concern in school and college gymnasium classes where a definite class schedule is followed, where the time between classes is limited. From the standpoint of health, some method of drying the hair is a necessity if the students must venture outdoors immediately after the session in the gymnasium. It is also a necessity if the school or college wishes to provide facilities which will enable the students to be consistent with the teachings of physical education. However, the cost of appropriate commercial driers in many cases prohibits the installation of proper hair-drying facilities.

The drier described in this article will dry wet hair in a few minutes and will accommodate several people, thereby enabling a large class or group to be acccommodated in a short time. The cost is low when considered on the basis of capacity, efficiency, simplicity, and maintenance.

The construction, with the exception of the hot-air chamber, is largely a matter of assembling standard parts and units, as a study of Figure 1 will reveal. The capacity may be increased or decreased as desired by simply providing fewer or more drying tubes and smaller or larger blowers and heaters. The drying is accomplished by hot air. A blower driven by an electric motor provides the hot-air blast by drawing cold air through an air-heating unit operating on the regular steam-heating system and forcing it into the hot-air chamber from which it passes into flexible rubber tubes attached to outlets at the bottom of the chamber.

The drawing shows the schematic layout and assembly of the drier. The air-heating unit is a steam air heater (manufactured by the Aerofin Corporation). It is piped to the steam line in the same manner as an ordinary radiator. A valve in the feed line is provided for turning on or shutting off the steam. The blower is mounted beside the heater and a transition piece and

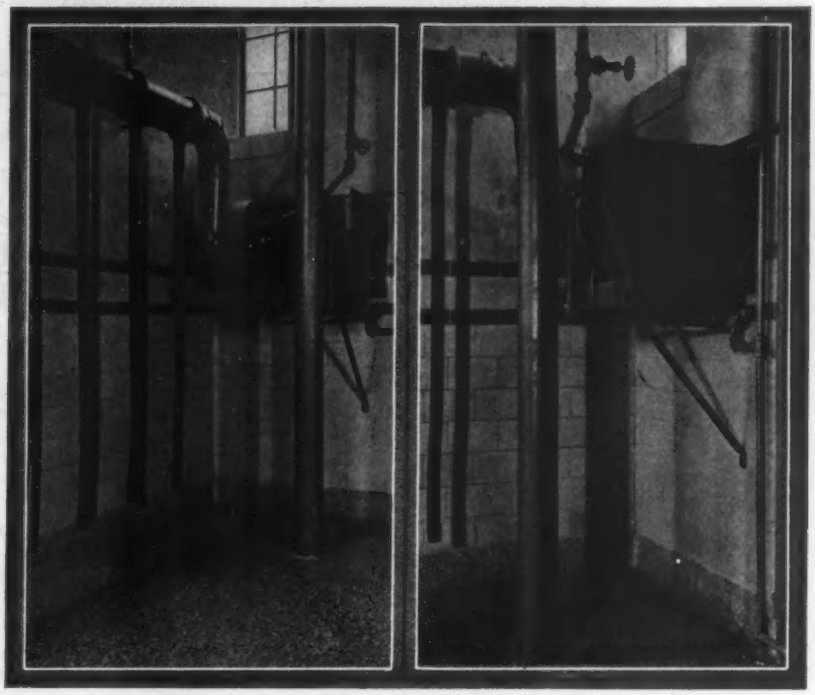


Fig. 2. Two views of the hair-drier installation

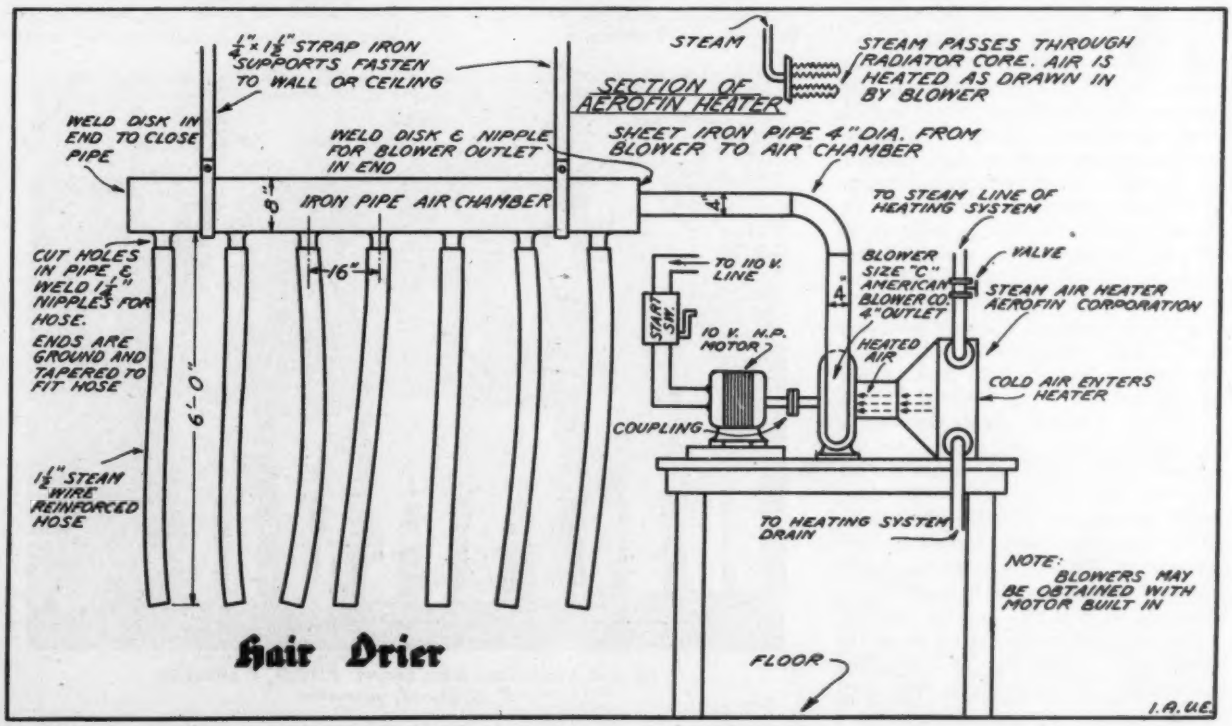

1/4" x 1 1/2" STRAP IRON SUPPORTS FASTEN TO WALL OR CEILING
STEAM
STEAM PASSES THROUGH RADIATOR CORE. AIR IS HEATED AS DRAWN IN BY BLOWER
SECTION OF AEROFIN HEATER
WELD DISK IN END TO CLOSE PIPE
WELD DISK & NIPPLE FOR BLOWER OUTLET IN END
SHEET IRON PIPE 4" DIA. FROM BLOWER TO AIR CHAMBER
8"
IRON PIPE AIR CHAMBER
4"
TO STEAM LINE OF HEATING SYSTEM
VALVE
CUT HOLES IN PIPE & WELD 1 1/2" NIPPLES FOR HOSE.
ENDS ARE GROUND AND TAPERED TO FIT HOSE
16"
TO 110 V. LINE
BLOWER SIZE "C" AMERICAN BLOWER CO. 4" OUTLET
STEAM AIR HEATER AEROFIN CORPORATION
START SW.
10 V. H.P. MOTOR
HEATED AIR
COLD AIR ENTERS HEATER
6'-0"
COUPLING
1 1/2" STEAN WIRE REINFORCED HOSE
TO HEATING SYSTEM DRAIN
NOTE: BLOWERS MAY BE OBTAINED WITH MOTOR BUILT IN
Hair Drier
FLOOR
I.A.U.E.

Fig. 1. How the hair drier is assembled

pipe installed between the blower intake and the heater so that only the heated air is allowed to enter the blower. The blower forces the hot air into the hot-air chamber through the sheet-metal conducting pipe. The blower should be of sufficient size so that each drying tube is provided with a uniform supply of hot air. The air chamber is made from an iron pipe 8 in. in diameter. Holes are cut on a line, in the bottom of the chamber and pipe nipples welded over each hole for the drying tubes. The nipples should be ground to a taper before welding so that the tubes may be readily attached. A hose clamp should be placed on each tube over the nipple to hold it securely in place. A ring, with a nipple for attaching the conducting pipe, is welded into the intake end of the hot-air chamber. A solid disk is welded in the other end of the chamber to seal it. Pipe caps instead of the disks may be used. The motor, blower, and heater, may be installed on a bench or on a wall shelf. The air chamber should preferably be suspended from the ceiling about 3 or 4 ft. from a side wall so as to provide ample space for the groups using the drier.

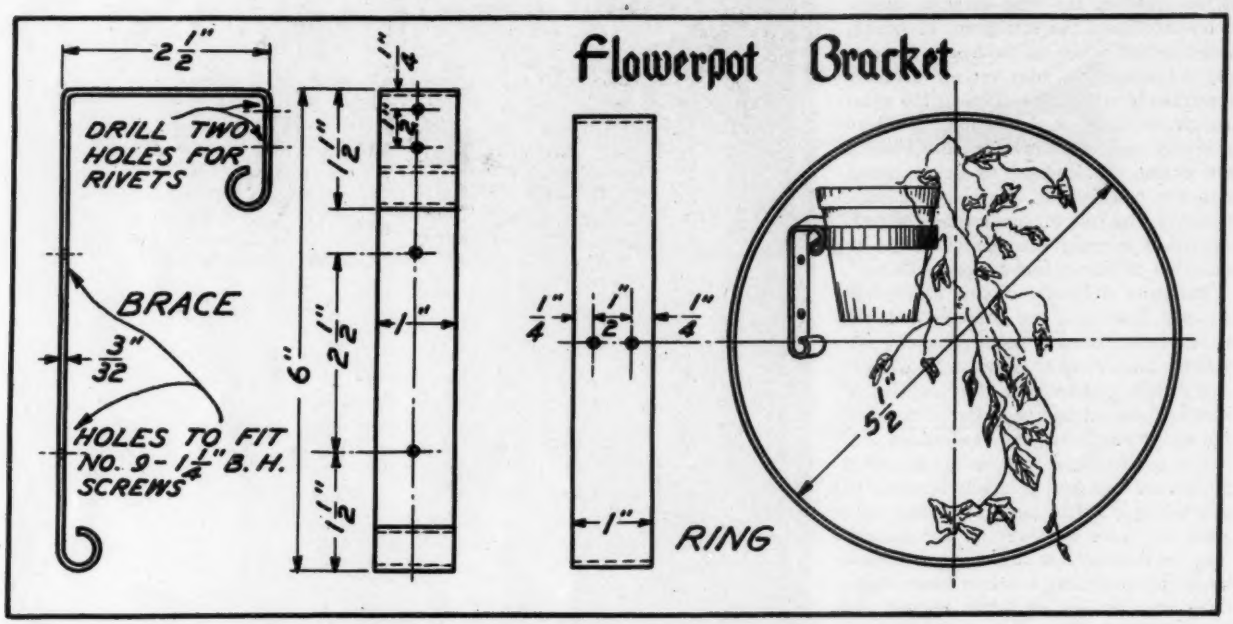
The drier is used by simply throwing in the starting switch and turning on the steam. In a few minutes the heater will get sufficiently hot to heat the air. The drier may, of course, also be used without heating the air; that is, using the air at room temperature. The hair is dried by simply holding the end of the tube in the hand and letting the air blast play over the wet hair.

The accompanying illustration shows the installation of a drier such as is described in this article. It has been successfully used in the girls' shower room in the local high-school gymnasium for the past two years.

FLOWERPOT BRACKET

Fred W. Megow, Philadelphia, Pennsylvania

The bracket shown herewith makes a very good metalworking problem. It can be made without much difficulty. The ring is welded and fastened on the brace by means of rivets. Two holes are drilled into the brace which are used for fastening to the wall by means of screws.



A VACATION ENJOYED BY STUDENTS OF ELECTRICITY

B. E. Smead, High School, Everett, Washington

For several summers it has been my privilege and pleasure to take small groups of my Smith-Hughes electrical-trade boys to the country for obtaining practical experience in house wiring. We selected districts where the power company was running an extension. It proved an easy matter

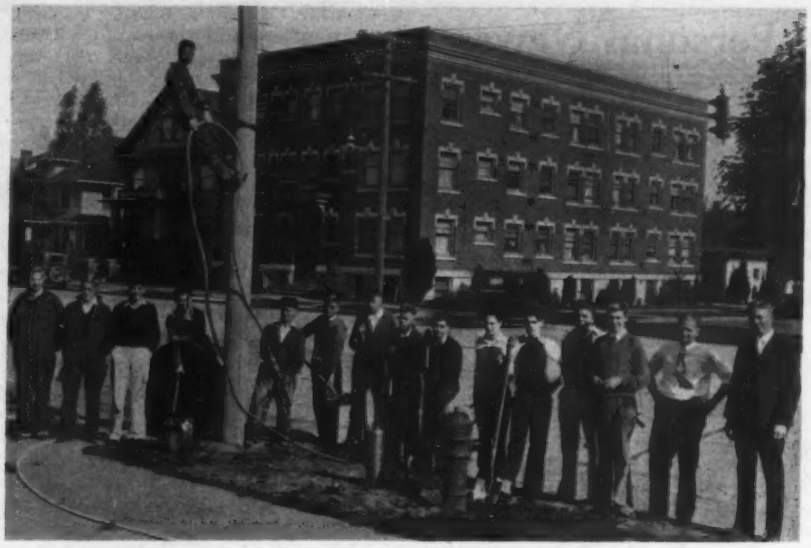
Electric trade class, High School, Everett, Washington
B. E. Smead, instructor

to sell our plan to the farmers, as we agreed to wire their houses and out-buildings for a labor charge of $8.00, they to pay for the material used and to give board and room to the two boys doing the job.

It took from three days to a week to wire each place. My job was to keep the boys in material, route them from place to place, and give what aid and encouragement were necessary to help them over the rough places. No pseudo jobs these. They had to work their ways out of some pretty tough places, for the men who built those farmhouses did not leave spaces for the easy running of electric wires.

From a financial standpoint, the plan is not a success, for the small profit made on materials just about paid my gas and oil. But, as a vacation, it proved the most pleasant and profitable of any I have ever taken.

The boys enjoyed the summer work immensely, learned a lot, and seemed well satisfied with their small earnings.



Trade class, Everett High School, erecting traffic signals. From right to left, Mr. Murdock, Principal, B. E. Smead, Instructor in electrical trades

INSTALLING TRAFFIC SIGNALS

B. E. Smead, Instructor in Electric Trades, High School, Everett, Washington

From many standpoints the installing of two traffic signals on the through street which bisects the high-school grounds was the best project that has yet come to the hands of the electric-trade class. No other project has called for the co-operation of so many different agencies. Our principal first talked over the plan with our financial secretary. Then the idea was sold to the school board. After getting their O.K., the matter was taken up with the city fire and safety departments and then with the power company.

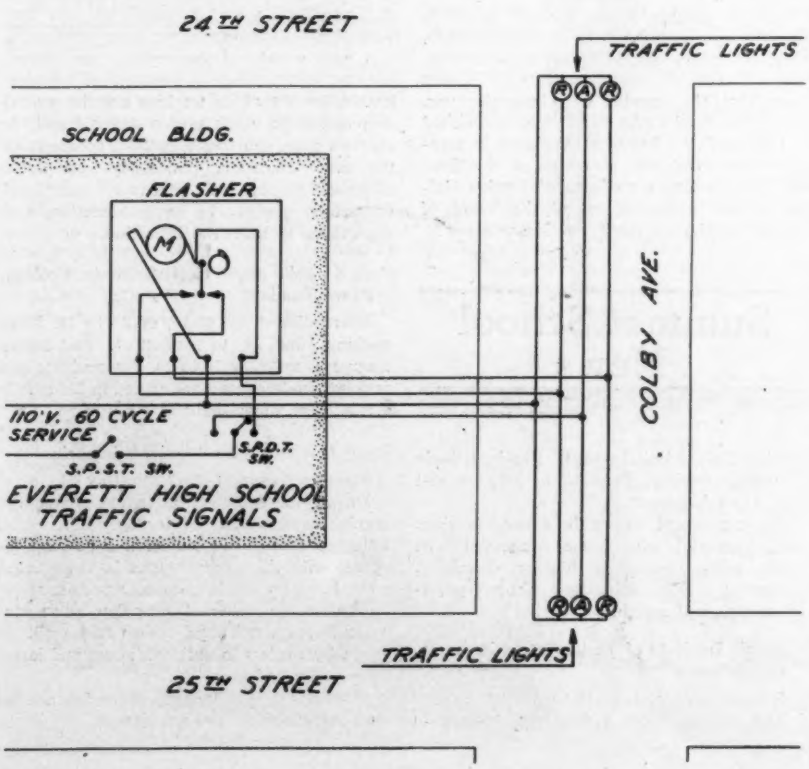
It pleased the school board to know that the electric shop could do the job, and incidently save them some money. Another pleasant feature was the favorable comment of the daily papers.

The apparatus was chosen with great care so as to comply with all city regulations. The signals were of the railway type with three lights, the upper and lower being red, and the center one amber colored. The signals were suspended vertically, with 14 ft. clearance above the street.

The lights with their flasher proved of great interest to the students, and because of this and the amount of discussion they provoked, were left on display at each of the junior-high shops for a few days. As purchased, the signals were equipped for manual operation only. After a lesson and discussion on the blueprint which accompanied the signals, the students entered a competition to see who could work out the best scheme for extending the circuit so that the signals could be worked by any individual at the curb, when desiring to cross the street. The more advanced students drew plans for automatic operation by connecting up with the master clock.

As the controls were to be in the principal's office, 550 feet of lead-covered cable had to be laid and a 16-in. concrete wall had to be pierced.

The power company set the poles and hung the signals, but this still left the boys a chance to show their climbing ability as they joined the lead-covered cable to the loom-covered wires that ran along the messenger cable to the lights.



DRESSING CARBORUNDUM STONES

Robert Studebaker, Northridge High School, Dayton, Ohio

An effective method of dressing carborundum whetstones after they have become uneven from constant use, is to rub them on a flat iron plate using ordinary sharp or white sand for grinding material. Most stones can be brought to a plane surface in less than an hour by this method.

Personal News

DEATH OF WILLIAM J. BOGAN

William J. Bogan, superintendent of the public schools of Chicago for eight years, died of heart disease at his home, on March 24. He was 65 years old. Mr. Bogan had been ill since February 1, suffering from overwork, a severe cold, and a digestive disturbance.

Born at Mackinac Island, October 26, 1870, Mr. Bogan received his elementary and high-school education there. For a time after graduation, he taught in grammar and high schools in northern Michigan.

In 1893, Mr. Bogan went to Chicago, where he obtained a teaching position in the Washington School. He remained there until 1900, when he was appointed principal.

In 1905, he was transferred to the Lane Technical High School, and remained there as principal until 1924, when he became assistant superintendent of schools in charge of high schools and night schools. He was appointed superintendent of schools to succeed William McAndrew in 1928.

Mr. Bogan was considered an authority on vocational education. While at the Lane School, he built it up into one of the finest technical schools in the country. He was an advocate of close co-operation between elementary and high schools, colleges, and universities, and he fostered junior high schools as a part of the city school system. He placed particular emphasis on the education of those who do not expect to go to college, and to that end he was instrumental in organizing Chicago's evening schools.

JAMES G. RIGGS DIES

Dr. James G. Riggs, principal of the Oswego Normal School from 1913 to 1933, died February 20, at Oswego, N. Y. He was 74 years old.

Born at Dexter, N. Y., May 21, 1861, Dr. Riggs attended the State Normal School at Pottsdam, received his A.B. degree at Amherst in 1888, and his A.M. degree there in 1893. After leaving Plattsburg, he taught at Dobbs Ferry, and then became superintendent of schools at Orange, N. J. In 1913, he became principal of the Oswego Normal School.

DEATH OF MR. NELSON A. GLADDING

Mr. Nelson A. Gladding, vice-president and sales manager of E. C. Atkins & Company, saw manufacturers, Indianapolis, Ind., died suddenly on March 8, in Portland, Ore., following an attack of heart disease.

He was born July 8, 1863, at Providence, R. I., and received his education in the public schools of that city and of Champaign, Ill. He also attended the Bryant and Stratton Business College in Indianapolis.

Following a long business career, which he began as a clerk in small retail stores, Mr. Gladding in 1881 was appointed secretary to the secretary treasurer of the Missouri and Kansas Telephone Company at Kansas City, Mo. Later he became traveling auditor for the company.

In 1883, he returned to Providence, and for two years was connected with Brown Brothers & Company, mill supply dealers. In 1885 he went to Indianapolis to enter the employ of E. C. Atkins Company as traveling salesman. Later he was appointed manager of the Atkins branch house in Memphis, Tenn., then was promoted to the office of secretary and sales manager of the Company, and in 1901 was made vice-president, a position which he continued to hold up to the time of his death.

Mr. Gladding was a member of the Inter-American High Commission Group Committee for Panama, and was prominently identified with many civic and welfare movements in Indianapolis.

DEATH OF FRANK A. BALDWIN

Frank A. Baldwin, 82, president of the Oliver Machinery Company, Grand Rapids, Mich., died at his home on March 7, after an illness of two weeks.

Born at Fremont, Ohio, Mr. Baldwin was graduated from the law department of the University of Michigan in 1877. Following his graduation, he went to Gaylord, where he became interested in railroad work and lumbering. In 1887, he went to Grand Rapids to begin the manufacture of saw swages, under the firm name of Baldwin, Rhodes & Company, with Mr. Baldwin as business manager. This firm later became known as Baldwin, Tuthill & Bolton, who took over the management of the Oliver Machinery Company in 1912. Under the new management the company expanded and continued the development of fine woodworking machinery.

Mr. Baldwin is survived by his widow, Mrs. Nellie O. Baldwin, and two sons, both of whom are associated in the work of the Oliver Machinery Company.

MILES W. O'BRIEN DIES

Mr. Miles W. O'Brien, president of the South Bend Lathe Works at South Bend, Ind., died on February 20, at West Palm Beach, Fla., where he had been vacationing. Mr. O'Brien was 64 years old.

Born in County Cork, Ireland, in 1871, Mr. O'Brien was brought to the United States when two years old. With his twin brother, John J. O'Brien, he became well known throughout the country as a manufacturer. The South Bend Lathe Works was established in 1906, and the brothers alternated in serving as president and secretary of the firm. Mr. O'Brien was a graduate of Purdue University and was treasurer of the board of trustees of the University of Notre Dame.

Summer School News

Bradley Polytechnic Institute, Peoria, Illinois

Summer sessions, June 15 to July 24 and July 27 to August 28.

Subjects offered during the summer sessions are: Industrial arts, home economics, art, music, college courses in biology, chemistry, economics, English, education, history, political science, and speech.

Carnegie Institute of Technology, Pittsburgh, Pennsylvania

Summer session, June 26 to August 7.

This school offers a two-week course in woodworking and practice teaching from June 15 to 26. The following six-week courses are offered: Woodworking, sheet metal, art metal, electricity, machine shop, welding, ornamental iron work, mechanical drawing and a wide range of theory courses. An advanced six-week course in printing also is offered. Besides the foregoing, there are courses in drama, art, music, sculpture, architecture, and engineering.

The location of this school makes inspection trips to leading industries and vocational schools possible. There also will be a two-day conference on industrial educational problems.

Kansas State Teachers College, Pittsburg, Kansas

Summer session, June 1 to July 31.

Undergraduate and graduate work offered. In the undergraduate work, there will be courses in drawing and design, metal work, woodwork, printing, auto mechanics, finishing, upholstering, electricity, and professional courses, dealing with organization, supervision and the teaching of industrial subjects.

The graduate work will consist of studies in industrial arts and vocational education, emphasizing means and methods for the improvement of teaching.

University of Minnesota, Minneapolis, Minnesota

Summer quarter, June 15 to July 25 and July 27 to August 29.

This university offers a four-year curriculum, B.S. degree, industrial-arts and Smith-Hughes work, unexcelled recreational program, wide range of manipulative courses, co-operative agreement with Dunwoody Institute, excellent library facilities, and opportunities for graduate work.

Oregon State College, Corvallis, Oregon

Summer session, June 22 to July 31. Postsession, August 3 to August 28. Graduate and undergraduate work in industrial arts and vocational education.

A wide variety of shop courses are offered, together with courses in industrial-arts organization, trade analysis, teaching aid, the general shop and its problems, project analysis, and the contract plan, conference method, co-operative part-time education, philosophy, vocational education, vocational guidance, vocational counseling, seminar in adult education, and supervision in industrial education.

Pennsylvania State College, State College, Pennsylvania

Intersession, June 9, 15, or 22 to 26. Main session, June 29 to August 7. Postsession, August 10 to 17, or 24 to 28. Postgraduate and undergraduate courses are offered in industrial-arts and vocational-industrial education.

Stout Institute, Menomonie, Wisconsin

Summer session, June 22 to July 31.

During the summer session are offered the regular courses required for the B.S. degree, home economics and industrial education, together with short-unit courses in these fields, special short units in consumer problems, coordination in vocational education, adult education, and curriculum construction will be given by readers in national, state, and large-community activities.

Graduate courses in home economics and industrial education also are offered.

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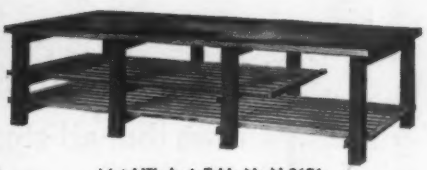
Single Manual Training Bench No. N-3088

Drawing Table No. BL-94


Metal Worker's Table No. N-3151

Ever-Hold Steel Stool No. 618-24

Combination Padlock No. K-46A

Combination Padlock No. K-45A

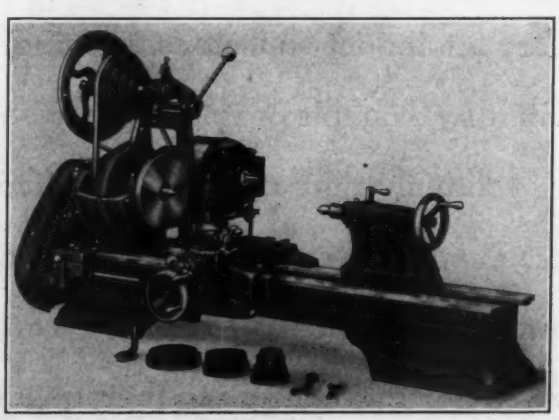
Ever-Hold Steel Stool No. 518-24

School-Shop Equipment News

ATLAS METAL-CUTTING LATHES

Streamline designs and scientific weight distribution, together with new mechanical features, are incorporated in the new Atlas line of metal-cutting lathes just announced by the Atlas Press Company, Kalamazoo, Mich.

These new lathes are the result of two years of study on the part of the firm's engineers. The 36-in. back-geared screw-cutting lathe has a threading-cutting range of 4 to 96 threads per inch, 16 speeds, fully enclosed on and off switch, automatic reversible power feeds, threading dial, graduated tailstock ram, V-belt drive, and many other features.



The Atlas lathes are not a *de luxe* addition to the firm's present line, but represent a new standard of lathe values to fit present-day demands in the field.

Complete information will be given to any shop instructor who requests it.

PEASE MODEL 7 CONTINUOUS PRINTER

The C. F. Pease Company, 802 N. Franklin St., Chicago, Ill., has announced a continuous printing machine for the production of blueprints and other prints at a low cost. The machine known as the Pease Model 7, has been developed to meet a growing demand for a convenient and dependable method of reproducing quickly and economically tracings, charts, diagrams, and bulletins in a variety of forms, including blueprints, brownprints, and direct-process prints in dimensions up to 42 inches in width.

The Pease Model 7 machine is of the horizontal type. Its construction is compact and sturdy, the design is such that the machine sets close to the wall, conserving floor space. It is finished in an olive-green crystallized baked enamel.

In operating the Pease machine the tracings and sensitized paper are fed into the machine at the front over the feed table, and on to an endless fabric band, which carries them upward, around, and through the machine in close contact with a curved section of polished plate glass where exposure

takes place. After the exposure, both tracings and paper are returned to the table. Good contact is assured at all times, and uniform tension of the band is maintained and controlled by a self-adjusting, spring-regulated, front-band roll. Uniform illumination is insured by an arrangement of 3½-ampere 50-in. mercury-vapor tubes. Three tubes provide sufficient illumination for a printing speed of two linear feet per minute, and four tubes a speed of two and one-half feet per minute.

(Continued on page 18A)

WHERE THE PATHS DIVIDE

Every educator knows that all students fall into two distinct groups... those who "can" and those who "can't". Sociologists find the same true of adult men. Some, it seems, are marked for success. Others, apparently, are doomed to mediocrity or downright failure despite seemingly equal opportunities.

What is this difference in men which sends some along the path to achievement and others down the dismal trail to disappointment? Usually it is a matter of *viewpoint*. Whether the student of today becomes a draftsman, doctor, salesman or mechanic in the world of tomorrow, his ability to discern between the good and the shoddy, his feeling for true craftsmanship, his reverence or indifference for ideals, will be major factors in his success.

"Viewpoint" is not a catalogued subject in any curriculum. Yet it has its place in every intelligent educator's teaching. It is taught by example or it isn't impressed on the youthful mind at all. It often finds its first expression in an instructor's attitude toward drawing instruments. When he shows genuine concern in their quality... in their accuracy... *in the maker's name*

College statistics show that faulty viewpoint is responsible for more failures than indolence. This, in itself, indicates the importance of the instructor's attitude in the earlier formative years of schooling.

on the instruments his pupils use, he has grasped a golden opportunity to create a correct "viewpoint" where the paths between success and failure divide.

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THE STOUT INSTITUTE

SUMMER SESSION — June 22, - July 31, 1936

Industrial Education and Home Economics for Teachers
Undergraduate and Graduate Courses

The summer session at The Stout Institute offers all the regular courses required for the B.S. degree in Home Economics and Industrial Education, and also many short unit courses in these fields. Subject matter courses are found in Science, English, Education, Vocational Education, Home Economics and Industrial Arts. These are supplemented by a program of well known special speakers and conference leaders.

Special short units in Consumer Problems, Coordination in Vocational Education, Adult Education, and Curriculum Construction will be taught by men and women who are leaders in national, state, and large community activities.

Menomonie is ideally situated, affording opportunity for professional study and recreational activities during the summer months. It is surrounded by beautiful lakes and rivers. It is within short driving distance of the north woods and lake resorts. Combine recreation with study.

Stout is now offering graduate courses in Home Economics and Industrial Education. These advanced courses are as distinctive as have been the courses at Stout in the undergraduate field. For forty years, Stout has been a leader in the fields of Home Economics and Industrial Education. Ask for full information.

Write for the Summer Session Bulletin
Director of Summer Session

The Stout Institute **Menomonie, Wisconsin**

(Continued from apge 15A)

The machine is driven by a sturdy, variable-speed motor, the speeds being controlled by a 28-point rheostat. Separate switches are provided for the motor and for each mercury tube, an extension cord and plug are standard equipment, and the machine can be connected with an electrical circuit of 20-ampere capacity and not exceeding 110 volts a.c. or d.c.

Complete information and prices may be obtained upon request.

SUMMER SCHOOL OF VISUAL EDUCATION

The annual DeVry Summer School of Visual Education will be held from June 22 to 25, in Chicago. The school offers an unrivaled opportunity for teachers and others to view in one place the outstanding films of the year, and to note the special features of industrial and educational films in the light of modern pedagogical and sales technique.

ANNOUNCE NEW 1936 MODEL 9-IN. WORKSHOP LATHE

The South Bend Lathe Works, South Bend, Ind., has announced a new 1936 model 9-in. workshop lathe with underneath-belt motor drive.

This lathe has a flat-belt or V-belt down drive to the lathe spindle, insuring a powerful, silent, efficient drive; an inclosed mechanism with screw-type belt-tension adjustment; belt-tension release for shifting the belt to change spindle speeds; twin-gear reverse for right- and left-hand threads and feeds; ball thrust-bearing on headstock spindle; large spindle bearings; felt shear wipers on saddle; strongly reinforced and webbed headstock casting; a base that is an accurate hand-scraped fit to the lathe bed, and numerous other refinements and improvements.

Complete information will be furnished to any school-shop instructor upon request.

THE NEW OZALID DEVELOPING MACHINE

The Ozalid Corporation, 354 Fourth Ave., New York City, has announced an improved Type 2000 developing machine for producing positive duplicates of drawings on paper or on tracing cloth or tracing paper.

In the Ozalid process, Ozalid sensitized papers or cloths are exposed with the originals in a blueprinting machine. They are then developed dry in the developing machine, producing prints that are true to scale, easy to read, and that can be written upon with ink or pencil.

The Type 2000 machine will develop Ozalid paper and cloth up to 42 in. wide, either in sheets or rolls, at a speed of 3 to 4 linear feet per minute. It uses two quarts of aqua ammonia for eight hours of continuous operation. At 110 volts the machine uses approximately 6 3/10 amps. of current for the heater and motor. The 8-12 minute warming-up period requires about 11 amps.

Complete information concerning the new machine will be sent to any school-shop instructor upon request.